

18
A
DESCRIPTION
OF THE ADMIRABLE
TABLE OF LOGA-
RITHMES:

WITH
*A Declaration of the most Plenti-
full, Easie, and Speedy vse there-
of in both kinds of Trigonome-
try, as also in all Ma-
thematicall Calculations.*

Invented and published in *Latine* by that
Honourable Lord IOHN NEPAIR, Baron of
MARCHISTON, and translated into Eng-
lish by the late learned and famous
Mathematician, EDWARD
WRIGHT.

*With an addition of the Instrumentall Table
to finde the part Proportionall, intended
by the Translator, and described in the end of the
Booke by HENRIE BRIGS Geometry-
reader at Gresham-house in
LONDON.*

All perused and approued by the Authour, and
published since the death of the Translator.
*Whereunto is added new Rules for the
ease of the Student.*

LONDON,
Printed for SIMON WATERSON,
1618.

gawdinge y^e Azim^{ut} of Os altit^{ude} e^y done
to finde the power of the day
as y^e cosine of the decli^{nation}
is to the sine of y^e azimuth
So the cosine of the alt^{itude}
to the sine of y^e power

gawdinge the power of y^e day the Os
altitude and the declination to
finde the azimuth

as y^e cosine of y^e altitude
is to the sine of the power
So the cosine of the declination
to the sine of y^e azimuth

gawdinge the distance of the
☉ from the next equinox point
to finde the right ascension

As the Radius
to the cosine of greatest decl^{nation}
So the tan^{gent} of y^e distance
to the tan^{gent} of right ascen^{sion}

gawdinge the tangent of declin^{ation}
of ☉ to finde the right ascension

as the tan^{gent} of greatest decl^{nation}
to the tan^{gent} declination given
So the Radius
to the sine of the right
ascension



An Appendix to the
Logarithmes, shewing
the practise of the Calculation
of *Triangles*, and also a new and
ready way for the exact finding out of
such lines and *Logarithmes* as are
not precisely to be found in
the *Canons*.



That great ease is offered
vnto vs in this art of Lo-
garithmic, for the resolu-
tion of all *Triangles* both
plaine and Sphaerickall
(without my speech) ex-
perience it selfe wil quick-
lie shew to such as haue at any time beene
tyred with the labourious worke of the for-
merly vsed tables of *Triangles*, I meane of
Sines, *Tangents* and *Secants*. Yet into the full
obtayning of the facility and readinesse
that the excellent inuention of this Author
may affoord vs, two things seemed vnto mee
conueniently might bee added hereunto:
The one is a direction for the practise of the
seuerall rules of the Calculation of *Trian-
gles*: The other is a perfect and readie way
of finding out such *Sines* and *Logarithmes*

which are not to be found exactly in the Tables. This latter the Author in the fourth Chapter of his first Booke, leaueth wondrously perplexed: and the Translator, that hee might bring some remedie to this difficulty, cutteth off quite the last figure of euerie number throughout the whole table, that so it might bee obuius to ordinary proportion: But neither yet will this effect what wee would for certaine of the first degrees, wherein the Logarithmes decreasing exceedeth proportion, & in such places where proportion will performe it, the worke for the most part is so manifold (astaking of three differences, then multiplying, and lastly diuiding) that the ease which the Booke promisseth is oftentimes dearely bought before wee can finde out the iust termes, and the vse of the translators instrument, is too much vpon coniecture and mechanically. I therefore hauing (at least to my seeming) supplied for mine owne priuate vse both these supposed defects, at the approbation and request of some of my friends studious in these Sciences, haue committed to the printer these few sides of paper, being not enuious to communicate to others any helpe, that may serue to gaine them time, a treasure in this our short life to be held most deare.

Certaine prenotions.

IN a right-angled Sphæricall Triangle only five circulare partes are obserued, which are these, the *Cathetus*, the *Base*, the *Hypotenusa* the *Angle* at the *Cathetus*, and the *Angle*

Angle at the Base : the right *Angle* it selfe being esteemed for nothing. And of these circular parts, it sufficeth to haue any two giuen, to finde out a third. So that onely three of these, are ingredient into our calculation.

But in a Sphæricall Triangle not quadrantal, there are sixe circular parts, which are these, the two sides, and the *Angle* intercepted therein, the *Base*, and the two *Angles* at the *Base*. Whereof three must needes be giuen, that a fourth may bee found out, so that onely foure of these are ingredient into one calculation : But if two of the parts giuen be opposite one to the other, and the fourth which is sought, bee opposite to the third (whether the Triangle bee plaine or Sphæricall) besides the three parts giuen you must also know concerning the fourth, whether it be greater or lesse then a quadrant. For if it appeare that the part sought out exceed a quarter of a circle, the Arch found out, is to be subtracted out of 180 degrees.

It will bee conuenient in euery calculation, to haue in your view a triangle, described according to the present occasion : and if it bee a right angled triangle, to note it with the Letters A. B. C. : so that A may bee alwayes the right angle ; B the angle at the Base B. A and C the angle at the Cathetus C A.



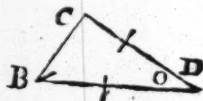
But if it be an obliquangle triangle, to note it with the letters BCD. BD being the base, and C the angle opposed thereto ; the sides whereof shall be C B and C D. for so, out of the angle C, the triangle may be diuided by a Cathetus or perpendicular C A into two

(4)

right angled triangles, AEC. & ADC
as you may see in
the figure.



Having thus described your triangle, note
the part thereof given
with a right line, & the
part sought with a cir-
cle. As in the figure we
are by the angle B, and
the two sides BD and CD to finde out the
angle D intercepted betweene them.



In euery feuerall calculation, I set downe
onely the practise plainly to the eye, as it is
to be wrought: wherein if you observe the
order & the notes, you shal not lightly erre.
The notes are these. For the Logarithme of
an arch or an angle, I set before it (s) for the
antilogarithme or complement thereof (s*)
and for the Differential (t) The Logarithme
of a straight line, hath no note beside his own
letters. The note of Addition is (+) of sub-
tracting (—) of multiplying (x) This note
([]) sheweth that the number set therein is
referred to diuide some other number: the
note of equality is (=) As for example:

$sB + BC = CA$. that is, the Loga-
rithme of the angle B. at the Base of a plain
right-angled triangle, increased by the addi-
tion of the Logarithme of BC. the hypote-
nusa thereof, is equall to the Logarithme of
CA the cathetus. And from hence plaine
reason will gather, that $CA = sB - BC$.
BC. or also that $CA - BC = sB$. that
is, that the Logarithme of the cathetus dimi-
nished by subtracting the logarithme of the
angle at the base is equall to the Logarith-

(5)

me of the angle at the base, is equall to the logarithme of the hypotenusa : or also that the same logarithme of the cathetus diminished by subtracting the logarithme of the hypotenusa, is equall to the logarithme of the angle at the base. For if the summe of any two numbers be equall to the third, the same third number diminished by any of the two former, must needs be equall to the other.

The calculation of a plaine right angled triangle.

If the hypotenusa be ingredient,

$$s B + BC = C A.$$

$$s C + BC = B A.$$

If the hypotenusa be not ingredient, *negotiorum*

$$t B + B A = C A.$$

$$t C + C A = B A.$$

The calculation of a plaine oblique angled triangle.

1. Either the foure ingredient parts are opposite two to two: as

$$s B + B C = s D + B D$$

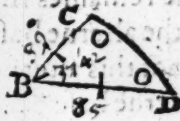


2. Or the two sides being giuen with the angle comprehended within them, either of the other two angles is sought.

The angle B is $37^{\circ} 14' 2''$.

The side B C is 39.

& the side B D is 85.



(6)

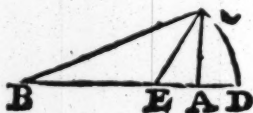
180		85		85 B D.
B 37° 42'		39		39 B C.
142° 18'	Diffra.	46	Summa.	124
Dim. 71. 9.				
Differentiall. + Logarithme. — Logarithme.				

The remaines shall bee the differentiall of Grad.

47° 22. $\frac{2}{3}$.		71° 9.
71. 9.	Dimid.	+ 71° 9.
1 47. 22. $\frac{2}{3}$		47. 22. $\frac{2}{3}$.
D 23. 46 $\frac{1}{3}$		118. 31 $\frac{1}{3}$. C.
The lesser Angle.		The greater angle.

3. Or else the three sides being giuen, the angles are sought.

The true basis I call the side subtending the angle sought for, namely, B D.



The alterne basis is that which is equally distant from the perpendicular on the contrary side as B E. the side B C. 54. the side DC. 38. and the true basis BD. 70.

Diff. 54	Sum. 54 B C.	
38	38 D C.	Basis
16	92	70 B D.
Logarithme. + Logarithme — Logarithme		

The remaines shall be the logarithme of the alterne base B E. 22. $\frac{2}{3}$. Subtract this alterne base, 21. $\frac{2}{3}$ out of the true base 70. & then there remaineth E A D. 48. $\frac{2}{3}$. the halfe whereof

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24. $\frac{3}{4}$ is AE or AD. And so haue you two plaine right angled triangles, A B C. and ADC. in each whereof, the basis and hypotenusa are giuen.

The calculation of a right angled Sphericall triangle.

Either the three partes ingredient follow not one another immediately as in these,

$$1. \quad s_* BA +_* CA =_* BC. \quad s_* *_* *_*$$

$$2. \quad \left\{ \begin{array}{l} s_* BC +_* s_* B =_* s_* CA \\ s_* BC +_* s_* B =_* s_* BA \end{array} \right\}$$

$$3. \quad \left\{ \begin{array}{l} s_* BA +_* s_* B =_* s_* B. \\ s_* CA +_* s_* C =_* s_* B. \end{array} \right\} \quad s_* *_* *_*$$

Or else the three parts ingredient do follow one another immediately, as in these :

$$4. \quad \left\{ \begin{array}{l} s_* BA +_* t_* B =_* t_* CA \\ s_* CA +_* t_* C =_* t_* BA \end{array} \right\}$$

$$5. \quad \left\{ \begin{array}{l} s_* B +_* t_* BC =_* t_* BA \\ s_* C +_* t_* BC =_* t_* CA \end{array} \right\} \quad s_* +_* +_*$$

$$6. \quad \left\{ \begin{array}{l} s_* BC +_* t_* B =_* t_* C \\ s_* BC +_* t_* C =_* t_* B \end{array} \right\} \quad s_* *_* t_* *_*$$

If one of the sides of a triangle sphericall be equall to a quarter of a circle, you shall note the same side with the letter A, and the other two with B and C. & then calculate it according vnto the six former examples, supposing the sides to be angles, and the angles sides.



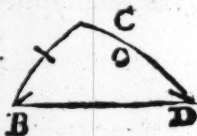
The

(8)

The calculation of a sphericall triangle, wherein neither the angle or side is equall to a quarter of a circle.

2. Either the foure ingredient are opposite two to two; as

$$\sin B + \sin B C = \sin D + \sin D C.$$



2. Or the three sides being giuen, one of the angles is to be sought out: Or contrarywise, two sides being giuen with the angle comprehended betweene them, the third side is to be found out.

The author in the 6. chapt. of the 2. book, setteth downe three wayes, to performe the former part of this Probleme; but neyther of them all will hold reciprocally to worke the latter part: I haue therefore (omitting all those three) set downe a more easie way of mine owne; both to finde the angle by the sides and basis thereof giuen; and also contrarily, the angle and sides containing it, being giuen, to finde out the basis thereof.

The rule is: if the Logarithme of the whol sinus be O, the logarithme of halfe the difference, of the sine of the complement of the base, from the sine of the complement of the difference of the sides is æquall to the sum of the logarithmes of both the sides together, with the double of the logarithme of half the angle comprehended. The practise.

(9)

106° DC Basis 2 are \square

38 BC • BD } given

Dif 68° 75°

Compl. 22° Compl. 15°

Sine — Sine. Take
halfe of the remains, and
out of the logarithme
thereof subtract the sum
of the logarithmes of the
two sides DC. 106° & BC 38°. Then divide
this latter remains into halfe. For halfe
thereof shall bee the logarithme of 18°. 13. &
an halfe, which being doubled giueth 36°. 27.
for the angle C.



And contrary wise if there be given
106° DC. 38° BC. 18°. 13. $\frac{1}{2}$
halfe the angle C. Logarithme. + Loga-
rithme. + Logarithme doubled.

Seeke the sine of the whole sum and double
it; take the double out of the sine of the co-
pleinent of the differēce of the sides (viz. 22°
as before) the remains shall bee the sine of
the complement of the base, BD. viz. 75.

3 Or else the three angles being one of
the sides is to be sought out: or contrariwise
two angles being given with the side lying
between them, the angle opposed vnto the
same side is required.

Here the angles must first bee conuerted
into sides, and the sides into angles, which is
most easily performed by prop. 11. chap. 6. of
the second booke. The rest is to be wrought
by my rule before deliuered.

4 But if the termes proposed in the questi-
on, fall not out to agree with any of those 3.
former suppositions: the triangle must bee a
cathetus or perpendicular arch, bee diuided

into

(10)

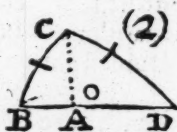
into two right angled triangles according to one of these six varieties ; and then the question shall be resolved by three severall operations as is heere set downe.

The two first operations of the three former varieties are these :

$$s BC \perp s B \equiv s CA.$$

$$s_* BC \longrightarrow s_* CA \equiv s_* BA.$$

The third operation of each is peculiar to it selfe.



(1) $t CA \longrightarrow s DA \equiv t D.$

(2) $s_* DC \longrightarrow s_* CA \equiv s_* DA. \quad s^*$

(3) $t CA \longrightarrow t D \equiv s DA.$

Again, the two first operation of the three latter varieties are these :

$$s BC \perp s B \equiv s CA.$$

$$s B \longrightarrow s_* CA \equiv s C.$$



The third operation of each is peculiar to it selfe.

(4) $t CA \longrightarrow s_* C \equiv t DC$

(5) $t CA \longrightarrow t DC \equiv s_* C$

(6) $s D \longrightarrow s_* CA \equiv s C$

Besides these six varieties there are no more. Only you must observe whether the cathetus or perpendicular arch falleth within the triangle.

(II)

triangle, or without it, that you may not mistake, in adding, or subtracting of the parts of the side, or angle, diuided by the cathetus.

Now followeth the way of finding out such sines and logarithmes, as are not in the canon precisely to be had: the ground of which worke is, because the differences of the sines and logarithmes in this canon, are equall so farre vntill the sine decrease about 980000. and the logarithme increase about 202000. Wherefore if wee shall by any art bring the logarithme, being it selfe great, that it may be lesse then 202000. or the sine being it selfe little, that it may bee greater then 980000. we may haue the difference to bee added, or subtracted, most readily without any proportion. For the performance whereof, I haue inuented and framed this Table following: which consisteth of two parts; the former being of absolute sines, the latter of tenth and hundredth parts.

The Table.

1	2	3	4	5	6	7	8	9	10
1000000	999999	999998	999997	999996	999995	999994	999993	999992	999991
1000000	999999	999998	999997	999996	999995	999994	999993	999992	999991

Sin.	Logarith.	Sin.	Logarith.	Sine.	Logarithme.
1	000000	100	4505168	10000	9210337
2	693146	200	5298314	20000	9803483
3	1096612	300	5703780	30000	10308949
4	1386294	400	5991462	40000	10596631
5	1609437	500	6214605	50000	10819774
6	1791758	600	6396925	60000	11002095
7	1945909	700	6551077	70000	11156246
8	2079441	800	6684609	80000	11289778
9	2197223	900	6802391	90000	11407560
10	2302584	1000	6907753	100000	11512921
20	2995730	2000	7600899	200000	12206067
30	3401196	3000	8006365	300000	12611533
40	3688878	4000	8294047	400000	12899215
50	3911021	5000	8517190	500000	13122358
60	4094342	6000	8699511	600000	13304679
70	4248493	7000	8853662	700000	13458830
80	4382025	8000	8987194	800000	13592362
90	4499807	9000	9104976	900000	13710144

*The Supplement of the Table for tenth and
hundredth parts.*

Sin.	Logarith.	Sin.	Logarith.	Sine.	Logarithme
11	95311	17	530618	104	39223
12	182321	18	587786	106	48790
13	262364	19	641853	107	58269
14	336473	101	9951	108	67659
15	405465	102	19803	109	76962
16	470004	103	29560		86177

To finde out the Logarithme of any sine or number wha shewer by helpe of this Table.

Multiply the number giuen by that sine in the former part of this Table which you find will bring it nereſt vnto 1000000. and if you finde the product lesse, then 980000. multiply the same product by one of the tenth parts; and if yet it be too little, multiply againe this latter product by one of the hundred parts. (Note that the multiplying by tenths and hundreth parts, is nothing else but to set the product made by the latter figure of the same partes one or two places backward.) Then hauing thus brought your number giuen to exceed 980000. seeke the logarithme of it in the canon, which you shall most easily finde onely by adding or subtracting the difference, as your owne reason shall direct you. Lastly, to this logarithme found out by the canon, adde the logarithms of the Table collaterall to the sine & parts wherewith you multiplyed, and the summe of all shall be the logarithme of the sine or number proposed: as for example, I would haue the logarithme of 257.

$$\begin{array}{r}
 257 \quad \times 3000 \\
 \hline
 771000 \quad \times 12 \quad \text{too little.} \\
 1542 \\
 \hline
 925200 \quad \times 108: \text{ yet too little.} \\
 7416
 \end{array}$$

999216 the logarithme of this by the canon at the first view, appeareth to be 748. vnto this adde the logarithmes of the table colaterall to 3000. & 12. & 108. & so

$$\begin{array}{r}
 784 \\
 8006365 \\
 182321 \\
 \hline
 76962 \\
 8266432 \\
 \text{shall}
 \end{array}$$

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shal you haue 8266432 for the true logarithme of 257.

Another example: I desire the logarithme of

403 $\frac{9}{1000}$	
40309. x 2000	
806180 x 12	
161236	
967416 x 103	
29022 48	
996438 Sine	
3568 Logar.	
	3568
	7600899
	182321
	29560
	7816348

Wherefore the Logarithme of 403 $\frac{9}{1000}$ is found to be 7816348.

*To finde out the sine or numerall valour of
any Logarithme whatsoeuer by this
Table.*

Out of the logarithme giuen, subduct the logarithme of the former part of this Table, which is next lesse then it, and out of the remaines subduct the logarithme next lesser of the tenth parts, & afterward the logarithme next lesser of the hundreth parts: & so will your logarithme become lesse then 202000. seeke therefore the sine thereof in the Canon, which you shall most easily finde only by adding or substracting the difference as you in reason shall see conuenient. Lastly, diuide this sine found out, increased with two circles by the hundredth part collaterall to the logarithme last subducted: Then diuide these quotient increased with one circle by the collateral tenth part; and afterward the quotient thereof by the sine in the former part of
this

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this Table, collateral to the logarithme sub-
 ducted; and this last quotient, shalbe the fine
 or numerall valour of the logarithme propo-
 sed. As for example. I would haue the fine
 or numerall valour of this logarith. 8266430.

8266432

8006365 [3000.

260067

182321 [12

77746

76962 [108

784. the fine whereof by the canon, of-
 fereth it selfe to be 999216. which must bee
 diuided as is shewed in the rule.

108)

12) 99921600 (9252000 (771000.

3000)

(2)7

So then the fine or numerall valour of the
 logarithme, 999216. giuen is 257.

Another example. I desire the fine of the
 logarithme, 7816348.

7816348

7600899 [2000

215449

182321 [12

33128

29560 [103

3568. Logarith.

996438 Sine. Diuide this as was taught by
 103)

12) 9964848 (9674160 { 806 180

2000)

{ 403 180

2000

Wherefore the fine or numerall valor of the
 loga-

logarithme 7816348 is $403\frac{2}{3}$ and thus for all other examples.

Note that if the Sine containe above fixe figures, you cannot exactly finde his logarithme by this canon: yet with very smal error you may doe thus: seuer the fixe first figures, and the rest account as a fraction: then hauing found out the logarithme thereof, ioyne thereto for many circles with the sign $+$ as there were figures more then fixe. So for the sine 997632645. take the sine 997632 $\frac{645}{1000000}$. to which agreeth the logarithm 2370. $\frac{355}{1000000} + 000$.

It is also to be vnderstood, that this Computation by the Table, properly belongs to logarithmes, and not to differentials. As for the differentials if they be very great (as in the three first degrees) they are to be calculated by the logarithmes standing beside the on the left hand, proportionably: for a Sine being giuen, you shall finde, first, the logarithme thereof by the Table, and afterwards the differentia by proportion. Againe, if a differentia be giuen, you shall find first, the logarithme by proportion, and afterward the Sine thereof by the Table.

Religiosum vult Deus.

To make a dial Declining
requiring: add the Lat° of the Loc. to
the anti- Lat° of the Loc° . the prod.
~~of the sample~~ is to be repeated
from Lat° Subst. the ~~sample~~
of the Declination the remant is
the distance of the meridian from
the horizon.

Invenire declinationem solis
veram

Adde hunc sine of greatest de-
clination to sine of huius
plan. Sed quod est huius numeri
sine

Alias ~~add~~ sine of the right ascension
of the sun tangent of the greatest
declination remane: is sine tangent of
Example of the suns decli-

repositione: Add sine tangent of the suns distan-
ce from the equator to sine of the
of the greatest declination & quod
is huius numeri sine

alias: Sub huius sine of the suns
distance out of the sine of the
of the greatest declination remane

Invenire: in Example of right ascension
a secundum add sine tangent of the suns decli-
nation to sine tangent of the latitude
solis quod est sine of huius numeri

alias per: sine tangent for
tabulas sine of the sine of the latitude
of the sun sine of the said
latitude & donec ad huius quotient to

the sine of the suns declination
and divide quod est by the sine
of the declination of the
quotient is huius numeri sine

huius difference converted into hours &
minutes and added to 6 hours is the time
of the suns setting when she is in the north
sine is in the south sine sub from 6 is
the time of the suns rising when she is in the north
is her rising in the morning

~~Instruments oblique a meridian~~
I. ~~Having y^e lat^e & distance from~~
to find his amplitude

or place: As y^e sine of y^e latitude
to y^e sine of greatest declination
So y^e sine of y^e place
to y^e sine of y^e altitude

alias: as y^e Radius
to y^e sine of y^e latitude
So y^e sine of declination
to y^e sine of y^e amplitude

2. Having y^e lat^e of y^e place
and dist^e of y^e ☉: to find y^e time
of y^e coming to east or west

as y^e tan^e of y^e latitude
to y^e tan^e of y^e declination
So y^e Radius
to y^e sine of y^e power from y^e
Meridian

alias as y^e sine of y^e latitude
west at. to y^e sine of y^e declination
titude at. to y^e sine of y^e declination
east at. to y^e sine of y^e declination
So y^e Radius -
to y^e sine of y^e altitude

3. Having y^e lat^e & dist^e of ☉
to find his altitude at y^e hour

as y^e Radius in proportion
to y^e sine of y^e declination
So y^e sine of y^e lat^e
to y^e sine of y^e altitude at 6

alias 4. as y^e sine of lat^e to y^e Radius
azimuth to y^e tan^e of dist^e to y^e tan^e of y^e
from y^e north of meridian

5. Havinge by lat: of place
and by determination of and by altitude
of 040 finde by Orizonte

As 90 in proportion
to the cosine of y^e altitude
1 500 to the cosine of y^e lat:
to a fourth sine

Declin. southe 20. 00 Dist: 110
altitud 12 7 Complement - 78
lat: N: 51 the comp - 38:30
the sume of all these - 220:30
the halfe sume is - 113:15
the Difference is: 3. 15

Then by the 4th sine
2 is to the sine of y^e halfe sume
soe the sine of the difference
to a 7th sine

Then divide y^e space betw^{ne}
the 7th sine and 90 degrees
into 2. equall partes and y^e
meane proportionall sine
will fall on 17. degrees
w^{ch} of comp: is 73 degrees
the double of 73. is the
Azimute required beinge

fonte Azimeth will be 36-26



TO THE RIGHT
HONOVABLE AND
RIGHT WORSHIPVLL
COMPANY OF MERCHANTS
of London trading to the East-
Indies, SAMVEL WRIGHT

*wisheth all prosperitie in this
life, and happinesse in the
life to come.*



Our fauours towards
my deceased Father,
and your employement
of him in businesse of
this nature, but chiefe-
ly your continuall int-
ployment of so many Mariners in so
many goodly and costly ships, in long
and dangerous voyages, for whose vse
(though many other wayes profitable)
this little booke is chiefly behoouefull:
may chalenge an interest in these his
labours. This *Book* is noble by birth, as
being descended from a Noble Parent,
& not ignoble by educatiō, hauing lear-
ned to speake English of my late Fa-

222
finer, a man in the iudgment of the learned, and experience of the common sort, famous for knowledge and practise in the Mathematickes: whose care thereof was so great, to send it abroad with the true resemblance of his worthy father, and sufficient knowledge of the English tongue to instruct our Countrey-men, that hee procured the Authors perusall of it: who after great paines taken therein, gaue approbation to it, both in substance and forme, as now I present it vnto you. I am the bolder thus to do, in regard it is not vnknowne to many men, that my said father spent a great part of his time in study of the Art of Nauigation, and had gathered much vnderstanding by his owne practise in some voyages to sea with the right Honourable the Earle of *Cumberland* deceased: whereupon he published a painful worke discouering errours committed by Mariners in that Art, with corrections and ready wayes for reformation therof. So that I thinke it is out of doubt, that his iudgement therein was great. And seeing hee not onely gaue much commendation of this worke (and often in my hearing) as of very great vse for Mariners:

ners:but also to help the want of those
that could not vnderstand it in Latine,
translated the same into English, and
added thereto an instrumentall Table
to finde the part proportional,whereof
also the noble Author approued well. I
doubt not but it is apparant enough
that he esteemed of it, and intended to
haue recommended it as a booke of
more then ordinary worth,especially to
Sea-men. But shortly after he had it re-
turned out of *Scotland*,it pleased God
to call him away afore he could pub-
lish it, or but write a description of the
said instrumentall Table which he had
deuised, therefore hee left the publish-
ing of it to me, as an inheritance, and
the said description to his learned and
kind friend Mr. *Henry Briggs*, who
hath performed it accordingly. All
which I humbly present vnto you, ho-
ping you shall receaue as much profite
by the vse of it, as there hath been lear-
ning, care, and paines bestowed in the
penning and sitting it thus to your
hands.



TO THE MOST
NOBLE AND HOPE-
FULL PRINCE,

CHARLES:

ONLY SONNE OF
the high and mightie IAMES by
the grace of God, King of great Brit-
taine, France, and Ireland: Prince
of Wales: Duke of Yorks and
Rothesay: Great Steward of
Scotland: and Lord of
the Islands.

MOST NOBLE PRINCE,



SEEING there is neither
study, nor any kinde of lear-
ning that doth more acuate
and stirre up generous and
heroicall wits to excellent
and eminent affaires: and
contrariwise that doth more deiect and keepe
downe sottish and dull mindes, then the Ma-
thematickes. It is no maruell that learned
and

Dedicatorie.

and magnanimous Princes in all former ages haue taken great delight in them, and that vnskilfull and slothfull men haue alwayes pursued them with most cruell hatred, as utter enemies to their ignorance and sluggishnesse. Why then may not this my new inuention (seeing it abhorreth blunt and base natures) seeke and flye vnto your Highnesse most noble disposition and patronage? and especially seeing this new course of Logarithmes doth cleane take away all the difficultie that heretofore hath beene in mathematicall calculations, (which otherwise might haue beene distastfull to your worthy towardnesse) and is so fitted to helpe the weaknesse of memory, that by meanes thereof it is easie to resolue moe Mathematical questions in one houres space, then otherwise by that wonted and commonly receiued manner of Sines, Tangents, and Secants, can bee done euen in a whole day. And therefore this invention (I hope) will bee so much the more acceptable to your Highnesse, as it yeeldeth a more easie and speedy way of accompt. For what can bee more delightfull and more excellent in any kinde of learning then to dispatch honourable and profound matters, exactly, readily, and without losse of either time or labour. I craue therefore (most gracious Prince) that
you

Dedicatorie.

you would (according to your gentlenesse)
accept of this gift) though small, and farr
beneath the height of your desertings, an
worth) as a pledge and token of my humble
service: which if I understand you doe, yo
shall (euen in this regard onely) encourage
me that am now almost spent with sicknesse,
shortly to attempt other matters, perhaps
greater then these, and more worthy so great
a Prince. In the meane while, the supreme
King of Kings, and Lord of Lords long de-
fend and preserue to vs the great lights of
great Brittain, your renowned parents, and
your selfe the noble branch of so noble a
stemme, and the hope of our future tranqui-
litie: to him be giuen all honour and glory.

Your Highnesse most
deuoted Seruant,

JOHN NEPAIR.



The Authors Preface to
the Admirable Table of Loga-
rithmes,



EEING there is nothing
(right well beloued Students
in the Mathematickes) that is
so troublesome to Mathema-
ticall practise, nor that doth more mo-
lest and hinder Calculators, then the
Multiplications, Diuisions, square and
cubical Extractions of great numbers,
which besides the tedious expence of
time, are for the most part subiect to
many slippery errors. I began therefore
to consider in my minde, by what cer-
taine and ready Art I might remoue
those hindrances. And hauing thought
vpon many things to this purpose, I
found at length some excellent briefe
rules to be treated of (perhaps) hereaf-
ter. But amongst all, none more profi-
table then this, which together with
the hard and tedious Multiplications,
Diuisions, and Extractions of rootes,

The Authors Preface.

doth also cast away from the worke it selfe, euen the very numbers themselves that are to be multiplied, diuided, and resolued into rootes, and putteth other numbers in their place, which performe as much as they can do, onely by Addition and Subtraction, Diuision by two, or Diuision by three: which secret inuention, being (as all other good things are) so much the better as it shall be the more common, I thought good heretofore to set forth in Latine for the publique vse of Mathematicians. But now some of our Countrey-men in this Island well affected to these studies, and the more publique good, procured a most learned Mathematician to translate the same into our vulgar English tongue, who after he had finished it, sent the Coppy of it to me, to bee seene and considered on by my selfe. I hauing most willingly and gladly done the same, finde it to bee most exact and precisely conformable to my minde and the originall. Therefore it may please you who are inclined to these studies, to receiue it from me and the Translator, with as much good will as we recommend it vnto you. *Fare yee well.*



A P R E F A C E TO THE READER

By *Henry Briggs.*



ENTLE Reader, seeing I haue publickly taught the meaning & vse of this booke at *Gresham* house, and haue had some charge about this Impression committed vnto me, both by the Honourable Authour the L. of *Marchiston*, and by my very good frend Mr. *Edward Wright* the Translator. And seeing the one who hath most right, and is best able to commend it, is so farre absent, and the other hath made a most happy change of this place and life for a better: thou maist happily expect that I should write somewhat that may giue some taste of the excellent vse of it to those who by reason of the distance of place, or other occasions, cannot come to heare me. In a word therefore I will bee bold to set downe mine opinion, writing nothing but that which I hope I shall alwayes be able and willing to make good ~~and maintain~~. There hath
beene

The Authors Preface.

been for many former ages euen vnto this present, a very great deale of time and expences bestowed by most industrious, learned, and worthy men about the doctrine of Triangles, and the making of the Tables of *Sines*, *Tangents*, and *Secants*, that by the helpe of them we may attaine to the knowledge and vse of the Mathematickes, and especially of Astronomic and Nauigation, as namely by *Hipparchus*, *Ptolomey*, *Theon*, *Regiomontanus*, *Copernicus*, *Reinoldus*, *Finkius*, *Lansbergius*, *Clavius*, *Adr. Romanus*, *Ioach. Rheticus*, *Valent Otho*, and *Pitiscus*. All these, and diuers others, to their exceeding praise, and the great ease & contentment of all such as set themselves to the serious studie of the Mathematickes, haue laboured much, and some of them bestowed very great cost, both of their owne estate, & also from the liberall contribution of sundry great Princes vpon the maintenance of diuers men, who for many yeares together haue wholly employed themselves to calculate these Tables. Yet notwithstanding this little Table of Logarithmes being first begun, and finished by the charge and paines of the honourable Authour alone, may for exactnesse and

M^r. Briggs Preface.

and certaintie compare with all those Tables, and for ease and expedition go very farre beyond them, for all Trigonometricall operations, especially Sphæricall, and for the making of the Tables of *Prosthaphæreses* for the Planets. Which considerations may iustly warrant the Title of *The Admirable Table of Logarithmes*. But besides all this, there is an other very excellent and admirable vse of this Table, which is not at all furthered by the other Tables formerly mentioned, nor can (for any thing I know) be any other way performed, but with very great paines and losse of much time: and that is in numbers continually proportionall, hauing any two numbers giuen with their distance, or with the number of meane proportionals betwixt them, at one operation to find any one of those meane proportionals, or any one of the numbers, without the giuen numbers at any distance assigned. And because these things may to some seeme obscure, giue me leaue to explaine the by an *example*. Let the two giuen numbers be 1. and 3000. and let there be supposed foure meane proportionals betwixt them. If of these foure I desire that which is nearest

Mr. Briggs Preface.

rest to the lesse extreame, that meane,
(because here the lesse extreme is an vnity) is called the surfolide root of the other extreame, to wit, of 3000. and that, or any other root may farre more easily be had by these *Logarithmes* then by any rule or other way. But the finding of any root is but one particular meane proportionall, to wit, the next meane to the vnity: and this way is generall, giuing as easily the third or fourth meane as the first. And not onely where the one extreame is an vnity, but betwixt any two numbers assigned. For example, if the giuen extremes bee 19 and 738. and there shall be betwixt these two, ten meane proportionals: by this Table we may finde the 7th or 8th, or any other assigned, from the lesse or from the greater number: or if they be continued further either diminishing vnder 19. or increasing aboue 738. we may finde any of them for any distance assigned, as the fifth or sixth in the same proportion aboue 738, or vnder 19. And thus hauing two extremes giuen, and the number of meane proportionals betwixt them, we may finde any, for any assigned distance within or without. In like sort, hauing a proportion assigned
in

M^r. Briggs Preface.

in numbers, and a third number giuen,
we may from that third number find an
extreme: betwixt which and that third
number shall bee any set number of
meane proportionals, keeping the pro-
portion assigned one from another. For
example, if 73 £ be yearly so to be in-
creased, as that $\frac{1}{16}$ be still to bee added
vnto the former yeares summe, and I
would know what is the whole at the
end of seuen yeares: here the proporti-
on assigned is 16 to 17 the third num-
ber, or the beginning of the progressi-
on is 73, the meane proportionals are
sixe: I would know the other extreme,
to wit, the seuenth from the beginning,
and by this Table of *Logarithmes* I find
it to bee 111 £, 11 s, 9 d $\frac{696}{1000}$, which
perhaps by curious search, after the la-
borious ordinarie way, will bee found
too great by $\frac{1}{1}$ of a peny, or therea-
bouts. And thus we see the admirable
vse of these *Logarithmes*, not onely in
the doctrine of Triangles (which I ac-
count to bee farre the most excellent
part, and which may by other Tables be
performed as exactly, but nothing so
speedily, or with the like ease) but also
in all our common accounts of ordinary
proportionall numbers: wherein wee
may

M^r. Briggs Preface.

may not expect the same exactnesse which we may attaine vnto by rule, and by long tedious practise, because this table is but small, and the numbers neuer exceed the eighth place; but wee may safely trust to it to performe all things without sensible error: or to performe truly, so farre as can be expressed in 7 figures. And if it shall please God (who besides his other mercies hath granted this honour vnto the Author, to begin and thus farre to accomplish this admirable worke) further to grant vnto him life and competent strength, I doubt not we shall haue the worke so enlarged and perfected, that we may vse it, both with greater ease, & with exactnesse vnto the 10th place. And thus commending these things to thy consideration, and vs and all our honest studies to the Lords blessing, I euer rest a louer of all them that loue the Mathematickes,

H. Briggs.



IV Hat, like our bodies, soules rare excellence,
Our bodies bound, yet haue thereof no sight.

Had stood twixt It and how it might be shewne.
But now it looks like selfe-Facilitie!

To ope the lockes of all their Mysteries,
That from all eyes so long conceal'd lay.

*As it could wish, or as it could have been—
In Art or Nature; yet Art miss of It.*

The Authors merit? No, it doth advance
His praise the more, the lesse he toil'd for thar.

For who with ease hath done what none ere could
Is most like God in workes of rarest skill:

*This argues He can do what ere he would
In Art with ease, if he had but a Will.*

* Wright (*ship-wright? no; ship-right, or righter* M. Wrights
when wrong she goes) to this, *with ease, will make* Tract of
Thy Rules to make the ship run rightly, when Nauigati-
she on.

*She thwarts the Maine for Praise or profits sake.
 If after-times, that still shall blesse his name,
 Shall seeke more ease than, in his easinesse,
 To worke by Figures, he must make Art lame
 (So lesse desir'd) with Eases great excessse!
 For his Rules are so firme and facill too,
 As makes Art laugh their quick-dispatch to waigh
 With Tangents and with Secants much-a-do,
 And Enuy with that ease to pine away. (sure
 O that great Lords no worse would use their lea-
 In severall kinds, then (kindly) were they Great:
 But they make small theselves with too-great pleasure:
 So, great-Lords th'are not, nor their Counterfet.
 Scotland, two Miracles of Men, this Age
 In thee affords the world, to future yeares:*

*Bucanan. The Tutor of our Rulers Pupillage,
 And this rare Lord, a Load-starre to his Peeres.
 The ground of whose iust praises is so sure, (wing:
 That it will beare more Fame then Fames right
 Birth, Grace, and Art, and all surpassing pure,
 Makes him more good then great, although a king.
 Then great good Lord, liue euer in my Lines,
 By thy iust lauds that shall then (dead) reuiue,
 Vnill the Sunne forsake the beauenly Signes,
 And in the Signes of thy worth euer liue. (thee,
 To light the world through them, & them through
 And me through both, to Fame, & that through me!*

*By the vnfained lover and
 admirer of his Art and
 matchlesse vertue,*

Iohn Dauies of Hereford.



In the iust praise of this Booke, Authour, and Translator.

Arts, in theſelues, haue ſuch diuine Perfection,
As Human reaſon cannot alwaies ſee;
Yet God all good, to man giues ſuch direction
As hidden things ſometimes diſcouered bee:
What many men and ages could not finde,
Is, at the laſt, by ſome one brought to mind.

This noble Author firſt due honour gaue
To him from whom true honours doe proceed, *
Who now to him doth graciouſly vouchſaue
Beſides his Stile, much honour for his meed,
By bringing Him thus clearly to reueale
Such profit both to Church & Cemon-weale.

This little Booke (to let the other paſſe)
As Title ſhewes, is truly admirable;
Th'inuention rare, for praſtiſe nothing leſſe,
Briefe, eaſie, plaine, and paſſing delectable.
What earſt was hard and tedious to unfold,
Here how to find with eaſe, is plainly told.

The toyleſome Rules of due Proportion
Done here by Addition and Subtraction,
By Bi partition and Tripartition,
The ſquare and cubicke rootes extraction:
And ſo, all queſtions Geometrickall,
But with moſt eaſe Triangles-ſphærickall.

By his
worke on
the Reue-
lation, firſt
printed in
An^o. 159
And a-
gaine in
An^o 161

The vse is great in all true Measuring
Of Lands, Plots, Buildings, and Fortification,
So in Astronomie and Dialling,
Geography and Nauigation.

In these and like, yong students soone may gaine,
The skilfull too, may saue cost, time, & paine.

In Latin to the world it first appear'd

Mr Wright Strange vnto them to whom that tongue is strange:
detected But he who earst our Nauigation clear'd,
& corre- From that strange tongue to English it did change.
cted ma- That famous, learned, Errours true Corrector,
ny errors Englands great Pilot, Mariners Director,
in the vul- whose care thereof was such, that he obtain'd
gar Nai- The Authors Approbation, and withall,
gation. He, for the helpe of Practisers ordain'd

A way to finde the part Proportionall:
The vse whereof too-timely death deny'd,
Which famous Briggs hath learnedly supply'd.

Thus haue you here the quintessence of Art,
Fitted to hand by men of rarest skill,
Whose enerlasting prailes in each part
So farre extend that here conclude I will.

And say, For Matter, Author, and Translator,
Nere had these Arts so good a Demonstrator,
Pulchra hæc facilia.

Ri. Leuee!

A VIEW OF THIS BOOKE.

<p>The Logarith- mes them- selves,</p>	<p>Nature { Vpspringing, <i>Booke 1. chap. 1.</i> { Affections <i>chap. 2.</i></p>	<p>Table { Description <i>Chap. 3.</i> { Vse thereof, <i>Chap. 4.</i></p>	<p>In Logarith- mes we con- sider</p>
<p>Their vse</p>	<p>Generall, <i>Chap. 1.</i> { Particular in triangles { Spharicall, { <i>quadrantal, cha. 4.</i> <i>Chap. 3.</i> { not-quadrantal. { <i>mixt, ch. 5.</i> <i>pure. cha. 9.</i></p>	<p>Right-lined. { Right-angled <i>Booke 2. Chap. 5.</i> { Oblique-angled <i>Chap. 2.</i></p>	<p><i>R. L.</i></p>

Some faults haue escaped in printing of the Table,
 which the practiser (if it please him to take the
 paines) may easily correct afore he use the Table,
 after this manner, or what else he shall find.

Dec.	mi		Dec.	mi	
0	10	Diff. 5839981	62	18	Sine 885392
0	11	Sine 3200	28	34	Diff. 607955
1	21	Sine 23560	61	1	Sine 874761
1	60	Log. 3355282	60	47	Log. 136071
2	1	Log. 3346986	60		Sine 874620
4	46	Log. 2487733	29	59	Diff. 549978
85	0	Sine 996195	60	20	Log. 140504
83	44	Sine 994025	21		Log. 140339
	3	Sine 992652	7		Log. 142668
8	33	Diff. 1894833	57	30	Sine 843391
81	30	Sine 989015	14		Sine 840882
11	18	Sine 195946	33	59	Log. 581692
	24	Log. 1621220	54	5	Log. 210818
78	42	Log. 19576	36	28	Sine 594355
13	45	Sine 237686	53	1	Diff. 283560
	46	Sine 237968	7		Diff. 287193
	47	Sine 238251	52	15	Log. 234850
	48	Sine 238533	38	26	Log. 475452
	49	Log. 1432062	59		Log. 463474
	50	Log. 1430380	51	0	Sine 777146
15	5	Sine 260224	4		Sine 777878
16	26	Diff. 1120955	19		Sine 780612
21	6	Sine 359997	38	49	Log. 467079
22	4	Diff. 902930	44		Log. 468889
	50	Log. 946616	39	13	Sine 632255
23	2	Log. 938366			
24	58	Diff. 764429			
64	2	Sine 899049			
27	4	Sine 455027			
	11	Sine 456839			
	20	Diff. 659953			
	31	Sine 462007			
62	30	Sine 887011			



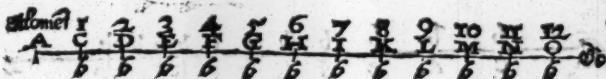
**A DESCRIPTI-
ON OF THE ADMIRABLE
TABLE OF LOGARITHMES,
WITH THE MOST PLEN-
TIFVL, EASIE, AND READY
Vse thereof in both kindes of
Trigonometrie, as also in all Ma-
thematicall Accounts.**

THE FIRST BOOKE.

**CHAP. I.
Of the Definitions.**



A LINE is said to increase equally, i. Definiti-
when the poynt describing the same, on-
goeth forward equall spaces, in
equall times, or moments.



Let A be a poynt, from which a line is to be
drawne by the motion of another poynt,
which let be B.

Now in the first moment, let B moue from

B **A**

A to C. In the second moment from C to D. In the third moment from D to E, & so forth infinitely, describing the line ACDEF, &c. The spaces AC, CD, DE, EF, &c. And all the rest being equall, and described in equall moments (or times.) This line by the former definition shall be said to increase equally.

A Corollary
or conse-
quent.

Therefore by this increasing, quantities equally differing, must needs be produced, in times equally differing.

As in the Figure before, B went forward from A to C in one moment, and from A to E in three moments. So in six moments from A to H: and in 8 moments from A to K. And the differences of those moments, one and three, and of these 6 and 8 are equall, that is to say two.

So also of those quantities AC, and AE, and of these, AH, and AK, the differences CE, and HK are equall, and therefore differing equally, as before.

2. Definiti-
on.

A Line is said to decrease proportionally into a shorter, when the poynt describing the same in equall times, cutteth off parts continually of the same proportion to the lines from which they are cut off.



For examples sake. Let the line of the whole sine a Z be to bee diminished proportionally: let the poynt diminishing the same by his motion

motion be b : and let the proportion of each part to the line from w^{ch} it is cut off, be as Q R to Q S . Therefore in what proportion Q S is cut in R , in the same proportion (by the 10 of the 6 of *Euclid*) Let a Z be cut in c , and so let b , running from a to c in the first moment, cut off a c from a Z , the line or sine c Z remaining.

And from this c Z let b proceeding in the second moment, cut off the like segment, or part, as Q R to Q S : and let that be c d , leauing the sine. d Z . From which therefore in the third moment, let b in like manner, cut off the segment d e , the sine e Z being left behiade. From which likewise in the fourth moment, by the motion of b , let the segment e f be cut off, leauing the sine f Z . From this f Z in the fifth moment, let b in the same proportion cut off the segment f g , leauing the sine g Z , and so forth infinitely. I say therefore out of the former definition, that here the line of the whole sine a Z , doth proportionall^y decrease into the signe g Z , or into any other last sine, in which b stayeth, and so in others.

Hence it followeth that by this decrease in equall moments (or times) there must needes also bee left proportionall lines of the same proportion. *A Corollary.*

For what continuall proportion there is before of the sines to be diminished, a z , c z , d z , e z , f z , g z , h z , i z , and k z , &c. and of the segments cut off from them, a c , c d , d e , e f , f g , g h , h i , and i k , there must needes be also the same proportion of the sines remaining, that is, c z , d z , e z , f z , g z , h z , i z , and k z , as may manifestly ap-

peare by the 19 Prop. 5. and 11. Prop. 7, Euclid.

3 Def.

Surd quantities, or unexplicable by number, are said to be defined, or expressed by numbers very neere, when they are defined or expressed by great numbers which differ not so much as one vnite from the true value of the Surd quantities.

As for example. Let the semidiameter, or whole sine be the rational number; 10000000 the sine of 45 degrees shall be the square root of 50,000,000,000,000, which is surd, or irrational and inexplicable by any number, & is included between the limits of 7071067 the lesse, and 7071068 the greater: therefore, it differeth not an vnite from either of these. Therefore that surd sine of 45 degrees, is said to be defined and expressed very neere, when it is expressed by the whole numbers, 7071067, or 7071068, not regarding the fractions. For in great numbers there ariseth no sensible error, by neglecting the fragments, or parts of an vnite.

4 Def.

Equall-timed motions are those which are made together, and in the same time.

As in the figures following, admit that B be moued from A to C, in the same time, wherein b is moued from a to c the right lines AC & ac, shall be sayd to be described with an equall-timed motion.

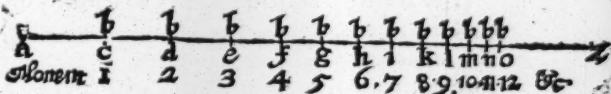
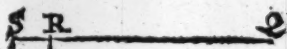
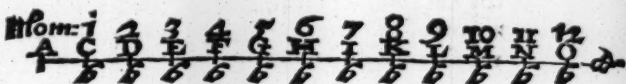
5 Def.

Seeing that there may bee a slower and a swifter motion giuen then any motion, it shall necessarily follow, that there may be a motion giuen of equall swiftnesse to any motion (which wee define to be neither swifter nor slower.)

6 Def.

The Logarithme therefore of any sine is a number very neerely expressing the line, which increased

sed equally in the meane time, whiles the line of the whole sine decreased proportionally into that sine, both motions being equal-timed, and the beginning equally swift.



As for example. Let the 2 figures going afore bee here repeated, and let B bee moued alwayes, and euery where with equall, or the same swiftnesse wherewith *b* beganne to bee moued in the beginning, when it was in *a*. Then in the first moment let B proceed from A to C, and in the same time let *b* moue proportionally from *a* to *c*, the number defining or expressing A C shal be the *Logarithme* of the line, or sine *c* Z. Then in the second moment let B bee moued forward from C to D. And in the same moment or time let *b* be moued proportionally from *c* to *d*, the number defining A D, shall bee the *Logarithme* of the sine *d* Z. So in the third moment let B go forward equally from D to E, and in the same moment let *b* be moued forward proportionally from *d* to *e*, the number expressing A E the *Logarithme* of the sine *e* Z. Also in the fourth moment, let B pro-

ceed to F, and b to f , the number AF shall be the *Logarithme* of the sine fz . And keeping the same order continually (according to the former definition) the number of AG shall be the *Logarithme* of the sine gz . AH the *Logarithme* of the sine hz . AI the *Logarithme* of the sine iz . AK the *Logarithme* of the sine kz , and so forth infinitely,

Therefore the *Logarithme* of the whole sine
A consequēt. 1000000 is nothing, or 0: and consequently the *Logarithmes* of numbers greater then the whole sine, are lesse then nothing.

For seeing it is manifest by the definition, that the sines decreasing from the whole sine, the *Logarithmes* increase from nothing: therefore contrariwise the numbers which yet we call Sines, increasing vnto the whole sine, that is to 1000000, the *Logarithmes* must needs decrease to 0. or nothing: and by consequent the *Logarithmes* of numbers increasing about the whole sine 1000000, which wee call *Secants*, or *Tangents*, and no more sines, shall be lesse then nothing.

Therefore we call the *Logarithmes* of the sines *Abounding*, because they are alwayes greater then nothing, and set this marke $+$ before them, or else none. But the *Logarithmes* which are lesse then nothing, we call *Defectiue*, or *wanting*, setting this marke $-$ before them.

It was indeed left at libertie in the beginning, to attribute nothing, or 0. to any sine or quantitie for his *Logarithme*: but it was best to fit it to the whole sine, that the Addition or Subtraction of that *Logarithme* which is most frequent in all Calculations, might neuer after be any trouble to vs.

CHAP. II.

Of the Propositions of Logarithmes.

THE Logarithmes of Proportionall numbers and quantities are equally differing. *Propos. 1.*

As for example. The Logarithmes of the proportionall sines, namely $e\alpha$, which is to $e\alpha$, as $b\alpha$ is to $k\alpha$, are respectively the numbers defining AC, AE, AH, AK, (as is manifest by the 6 Definition.) Now AC, and AE differ by the difference CE, and AH and AK by the difference HK. But by the first definition and his Corollarie CE and HK, are equall: therefore the Logarithmes of the fore-said proportional sines are equally differing. And so in all proportionals.

For what affections and syntomes the Logarithmes haue gotten in their first beginning and generation, the same must they needes retaine and keepe afterwards.

But in their beginning and generation, they are indued with this affection, and this law is prescribed vnto them, that they bee equally differing, when their sines or quantities are proportionall (as it appeareth by the definition of a Logarithme, and of both motions, and shall hereafter more fully appeare in the making of the Logarithmes.) Therefore the Logarithmes of proportional quantities are equally differing.

Of the Logarithmes of three proportionals, the double of the second or meane, made lesse by the first, is equall to the third. *Propos. 2.*

Seeing that by the first propos. the difference of the *Logarithme* of the first and second, is equall to the difference of the *Logarithmes* of the second and third, that is, the second made lesse by the first, is equall to the third, lesse by the second: therefore the second being added to both sides of the equation twice, the second, or the double of the second made lesse by the first, shall come forth equall to the third, which was to bee proved.

Propos. 3. Of the *Logarithmes* of three proportionals, the double of the second, or middle one, is equall to the summe of the extremes.

By the second Proposition next going before, the double of the second, made lesse by the first, is equall to the third. To both the equall sides adde the first, and there shall arise the double of the second equall to the first and third, that is, to the summe of the extremes, which was to bee demonstrated.

Propos. 4. Of the *Logarithmes* of foure proportionals, the summe of the second and third, made lesse by the first, is equall to the fourth.

Seeing by the first Proposition of the *Logarithmes* of 4 proportionals, the second made lesse by the first, is equall to the fourth lesse by the third: adde the third to both sides of the equality, and the second and third made lesse by the first, shall bee made equall to the fourth, which was propounded.

Propos. 5. Of the *Logarithmes* of foure proportionals, the summe of the middle ones, that is, of the second and third, is equall to the *Logarithme* of the extremes, that is to say, the first and fourth.

By the 4 proposition going afore the 2 & third

third made lesse by the first, were equall to the fourth: to both sides of the equality adde the first, and the second more by the third shall bee made equall to the fourth, more by the first, which was to be demonstrated.

Of the Logarithmes of foure continuall proportionals, the triple of either of the middle ones, is equall to the summe of the further extreame, and the double of the neerer. Propos. 6.

By the second proposition, the double of the second made lesse by the first, is equall to the third; and by the third proposition the double of this, that is, the fourefold of the second made lesse by the double of the first, shall be equall to the summe of his extreames, that is, the fourth more by the second. Now, if from both sides of the equality you subtract the second, the triple of the second made lesse by the double of the first, shall be made equall to the fourth. Again, to the sides of this equality adde the double of the first, and there shall arise the triple of the second, equall to the fourth, more by the double of the first, which wee undertooke to prove.

An Admonition.

Hitherto we haue shewed the making and Symptomes of *Logarithmes*; Now by what kinde of account or method of calculating they may be had, it should here bee shewed. But because we do here set down the whole Tables, and all his *Logarithmes* with their Sines to euery minute of the quadrant: therefore passing ouer the doctrine of making *Logarithmes*, til a fitter time, we make haste to the vse of them: that the vse and profit of the

thing being first conceiued, the rest may please the more, being set forth hereafter, or else displease the lesse, being buried in silence. For I expect the iudgement and censure of learned men hereupon, before the rest rashly published, be exposed to the detraction of the enuious.

CHAP. III.

Containing the description of the Table of Logarithmes, and of the seven Columnes thereof.

1 Section.



THE first Columne is expressly of the Arches increasing from 0 to 45 degrees, and is also understood to bee of their remainders to a semicircle.

2 Section.

The seventh columne is of arches decreasing from a quadrant to 45 degrees, and is also understood to bee of their remainders to a semicircle.

3 Section.

So the Arches of the one columne are the complements of the Arches of the other answering ouer-against them.

4 And in the first is expressed the lesse sharpe angle of any right-lined right-angled triangle.

5 But in the seventh ouer against it, is placed the greater sharpe angle of the same right-angled triangle.

6 In the second columne are the sines of the arches of the first columne.

7 And these are the lesse legges subtending the lesse angle of a right angled triangle, whose Base, or Hypotenuse is the whole sine.

8 In the sixth columne are the sines of the arches of the seventh columne.

CHAP. 3. The first Booke. II

And these are the greater legges subtending 9
the greater sharpe angle of the same right-angled
triangle, whose Hypotenuse is the whole sine.

Hence it followeth, that of the whole sine, and 10
the sine of the second columnne, and the sine of the
sixth columnne answering ouer-against the same,
there is made a triangle that is equiangled, and
like to any right-angled right-lined triangle.

The third columnne containeth the Logarithmes 11
of the arches and sines towards the left hand.

Which are the Logarithmes of the proportion 12
of the lesse legge of a right-angled triangle, to the
Hypotenuse of the same.

And they are also the Logarithmes of the com- 13
plements of the arches and sines towards the right
hand, which we call Antilogarithmes.

The fift columnne containeth the Logarithmes 14
of the arches and sines towards the right hand.

Which are the Logarithmes of the proportion 15
of the greater legge of a right-angled triangle, to
the Hypotenuse of the same.

They are also the Antilogarithmes of the 16
arches and sines towards the left hand, or the Lo-
garithmes of the complements.

Lastly, the fourth or middle columnne contai- 17
neth the differences betweene the Logarithmes of
the third and fiftth columnnes. And so this columnne
is two-fold, Abounding and Defectiue.

Those differences are Abounding, which arise 18
out of the subtraction of the Logarithmes of the
fiftth columnne from the Logarithmes of the third
columnne.

But the differences arising by subtraction of 19
the Logarithmes of the third columnne out of the
Logarithmes of the fiftth columnne, are Defectiue,
which therefore are lesse then nothing.

The Abounding differences are called the dif- 20
ferentiall

ferentiall numbers of the arches towards the left hand.

- 21 And are the Logarithmes of the proportion of the lesse legge of a right-angled triangle, to the greater legge of the same.
- 22 And are also the Logarithmes of the Tangents of the left hand arches.
- 23 But the defectiue Differences, are called the differentiall numbers of the right hand arches.
- 24 And are the Logarithmes of the proportion of the greater legge of a right-angled triangle, to the lesse legge of the same.
- 25 And are also the Logarithmes of the Tangents of the right-hand arches.
- 26 Also euery left hand arch, and the remainder thereof to a semicircle, is called the arch of the complement of the arches, sines, & right hand Logarithmes, and of the Defectiue differentials.
- 27 And contrariwise euery right hand arch, and the remainder thereof to a semicircle, is called the arch of the complement of the arches, sines and left hand Logarithmes, and of the Abounding differentials.

Admonitions.

- 28 **H**ere it is to be noted, that if you make the Logarithmes of the third column Defectiue, setting before them this marke, — they shall bee made the Logarithmes of the Hypotenuses or Secants of the right hand arches of the seventh column.
- 29 And these also shall bee made the Logarithmes of the proportion of the Hypotenuse of a right angled triangle to the lesse legge of the same.
- 30 And if you make the Logarithmes of the fifth column Defectiue, they shall bee the Logarithmes of the Hypotenuses, or of the Secants of the left hand

band arches of the first columnne.

The same shall also be the Logarithmes of the proportion of the Hypotenuse of a right-angled triangle to the greater legge of the same. But because the sines onely, and their arches, and the Logarithmes with their Differentials, are sufficient for attaining the knowledge of right-lined triangles, and for the knowledge of sphericall triangles, the arches onely with their Logarithmes and Differentials are sufficient without regard of the sines. Therefore we have excluded the Tangents, and the Hypotenuses, or Secants, out of the Table: and in sphericall triangles we will have the sines also not regarded; yet we will shew you by the way, that you may, if you list, use them all readily enough in right-lined triangles, but not in sphericall.

CHAP. IV.

Of the use of the Table, and of the numbers thereof.



The Sines, Tangents and Secants being precisely found in their Tables, to finde their Logarithmes as precisely.

SECT. I.

By the 11 and 14 Section of the third chapter, the Sine giuen being found in the second, or sixth columnne of our Table, the Logarithme thereof shall bee found in the third, or sixth columnne of the same line.

So therefore, the Logarithmes of the Sines that are in the table are exactly had. And the numbers of the Tangents and Secants being found in their owne Tables, you haue their arches.

And

And the *Logarithmes* being knowne, our Table giueth you the *Logarithmes* of the Tangents, or the differentials with their signes or marks in the middle columnne, by the 22 and 25 Sect. And the *Logarithmes* of the Secants reciprocal-ly in the third & fifth columnnes; yet setting before them this signe — by the 28 and 30 Sect. Therefore the *Logarithmes* of the Sines, Tangents and Secants that are in the Tables, are thus had.

Examples of Sines.

I Seeke the *Logarithme* of the sine 694658. I finde that sine precisely in the second columnne, answering to the arch 44 degrees, 0 min. & in the same line of the third columnne, there standeth ouer-against it, the *Logarithme* 364335 which I sought. Also let the *Logarithme* of the sine 721357 bee sought. This sine shall bee found answering to the arch 46 degr. 10 min. and neere adioyning thereto 326620. the *Logarithme* thereof that was sought.

Examples of Tangents.

L Et the *Logarithme* of the Tangent 218645 bee sought. To this Tangent there answereth in his Table the arch of 12 degr. 20 min. and to this arch in the middle columnne of our Table, answereth the *Logarithme*, or differentiaall abounding 1520306 which was sought. Also if you shall seeke the *Logarithme* of the Tangent 4573629. you shall finde in the Table of Tangents his arch 77 degr. 40 min. and the same differentials of this arch in our Table, but yet defectiue, that is, — 1520306.

Examples of Secants.

TO the Secant 1811801 there answereth in the Table of Secants, the arch 56 degr. 30 min. and to this arch in our Table agreeeth reciprocally — 594321 the defectiue Logarithme of the Secant 1811801, aboue written. So you shall find — 271425, the Logarithme of the Secant 1311834. & of the secant 1396059. you shall find the Logarithme — 333653.

To estimate the Logarithmes of the numbers 2 giuen, and not found in the Tables of the Sines, Tangents, and Secants.

Seeke the number that is most like the number giuen in the second or sixt columnne of our Table, whether it be ten fold, an hundred fold, a thousand fold, 10000 fold, 100000 fold, 1000000 fold: or if you will in the Tables of Tangents and Secants: and note the arche hereof. For the Logarithme thereof taken out of our Table, is that you seek for: yet keeping in minde, or for memory sake, setting downe in cyphers, the number of the places or figures of the multiplicitee. As if the Logarithme of the number 137 bee sought, which is not found in the Tables, you shall finde among the Sines 1454. 13671. and 137156. And among the Tangents 1370305. but among the Secants, the number 1370305 which is likest of all to the number giuen, if the last foure figures toward the right hand be vnderstood to be blotted out. Therefore let the Logarithme of this Secant 1370305, and of his arch 43 degr. 8. min. be sought out by the former Section, or by the 28 and 30 Sections of the third chapter, and it shall bee found — 315033, which is also taken for the

the Logarithme of the number giuen 137 remembring, notwithstanding, that the 4 last figures are to be cut off, or for memory sake to be noted thus expressly — 315033 — 0000 Likewise if by the Tangent aboue expressed, 1370505. you shall seeke the Logarithme of the number 137 by the arch of that Tangent 53 degr. 53. min. shall be found by the 25 Section in the middle columnne — 315179, the Logarithme of that Tangent 1370505 which because it exceedeth 137 the number giuen by foure places, or figures. Therefore — 315179 — 0000 shall be the Logarithme of the number giuen 137; yet this Logarithme is so much lesse exact by how much 1370505 is more vnlike to the number 1370000, or the 10000 fold of the number giuen. But this error exceedeth not $\frac{5}{100000}$. Lastly, if you shall seeke the Logarithme of the number giuen 137 by the Sine aboue written 137156. that shall bee found to bee 1986633. — 000 by this & the 11 Section of the third chapter. In like manner you shall work by the signe + when the number of the figures of the quantitie giuen, exceedeth the number of the figures of the sine that is likest thereto, which seldom happeneth. As if the Logarithme of the number (or discrete quantitie) 232702 bee sought for, you shall finde in the Table, the sine 2327 most like thereto; but it wanteth two figures. Therefore to the Logarithme hereof, found in the Table (by the 11 Sect. chap. 3) which is, 6063128. let be added two cyphers, the signe + being put betweene, and it shall be made 6063128 + 00 for the Logarithme of the number 232702. which was sought for.

But

But the best way of estimating Logarithmes, is that whereby they were first made, wherof we shall speake in another place.

Therefore as in the first Section going afore, simple and pure Logarithmes are given: so in this Section next going before by putting cyphers to them, they become impure. 3

To adde Logarithmes of like signes, is to giue the summe of them both, with their signe common to them both. 4

As by the Addition of $\text{---}56312$ to $\text{---}73495$. there shall come forth $\text{---}129807$. Also 4216 being added to $+ 5392$, there comes forth 9608 . So $3219\text{---}00$ added to $4350\text{---}000$ make $7579\text{---}00000$.

To adde the Logarithmes of unlike signes, is to giue the difference of them with the signe of the greater number. 5

As of the Addition of $\text{---}210$ to 332 is pronounced $+ 122$.

Also of the addition of $\text{---}210$ to 192 , comes forth $\text{---}18$.

So $\text{---}210 + 000$ added to $332\text{---}00$ are $122 + 0$.

Also $\text{---}210\text{---}000$ added to $192 + 00$, are $\text{---}18\text{---}0$.

Of two Logarithmes this is properly said to bee the Defectiue of that, and that the Abounding of this: when they haue both number and cyphers common, or the same, and all the signes $+$ and --- altogether contrary. 6

As of the Abounding Logarithme 56312 , the defectiue is $\text{---}56312$. Also of the Abounding Logarithme $56312\text{---}00$ the Defectiue is $\text{---}56312 + 00$. So of the Abounding Logarithme $56312 + 00$, the Defectiue is, $56312\text{---}00$.

7 To subtract an abounding Logarithme, is to adde his defectiue.

As to subtract the abounding Logarithme 56312 out of —73495, is the same as to adde his defectiue which (by the sixth Section.) is —56312 to the same —73495, and they shall bee made (by the 4 going before) —129807. So to subtract 56312 + 00 out of —73495 — 000 is the same as to adde —56312 + 0 to 73495 — 000, and they are made (by the 4 and 5 Sect. going before) —129807 — 00000.

8 To subtract a defectiue is to adde his abundant.

As to subtract a defectiue —4216 out of + 5392, is the same that it is to adde 4216 to 5392. and (by the fourth Section) to bring forth 9608. So it is the same to subtract —4216 + 00 out of 5392 × 0, that it is to adde 4216 — 00 to 5392 × 0. and to bring forth 9608 — 0.

To increase or diminish a Logarithme in number, his former value remaining, is to adde to it, or subtract from it, any of the Logarithmes following, as 2302584 + 0, or 4605168 + 00, or 6907753 + 000, or 9210337 + 0000, or 11512921 + 00000, signifying nothing at all.

As let the Logarithme bee 3916 — 0 where to if you adde any of them, as for example take, 2302584 + 0, there shall bee made thereof 2306500 greater in number, but in value altogether the same that 3916 — 0 is: for the quantity or numerall value of this Logarithme 3916 — 0 (by the 12 and 13 Sections following of this Chapter) is 996092, from which take onely the last

last figure, as — 0, signifieth, and it shall be made 99609. And the numeral value of that Logarithme 2306500 (by the 12 and 13 Sections following of this chapter) is also 99609 the same that was before.

An example of diminishing.

Let the Logarithme 2545177 bee to be diminished, from which if you subtract 2302584 + 0, there is left 242593 — 0 of the same value that this former 2545177 was. For the value of the simple and pure Logarithme 242593 is ten fold the value of either of them. Their values therefore are equall each to other. For the addition of the Logarithme 2302584 + 0, signifieth nothing else, but that the value of the number where-to it is added, is to be diuided into ten parts, and that one cypher is to bee added to this tenth part: but the subtraction of the same signifieth that the value of the Logarithme from whence it is subtracted, is made tenne fold more, and that one cypher is cast away from this ten fold. There remaineth therefore the same value in both of them.

So 4605168 + 00 added, signifieth that two cyphers are added to the hundreth part of the value: and being subtracted, it signifieth that two cyphers are cast away from the hundreth fold, and so of the rest aboue expressed.

An Admonition.

But because the addition and subtraction of these former numbers may seeme somewhat painfull, I intend (if it shall please God) in a second Edition, to set out such Logarithmes as shall make those numbers aboue written to fall upon decimal

decimal numbers, such as 100,000,000, 200,000,000, 300,000,000, &c. which are easie to bee added or abated to or from any other number.

- 10 If therefore you shall adde to a Logarithme that is diminished by some cyphers, or shall subtract from a Logarithme increased by cyphers, any of the Logarithmes aboue written that containe so many cyphers, there shall out of an impure Logarithme bee produced, a pure one of the same value.

As in the first example going before, let the impure Logarithme $3916 - 0$ bee to bee purged from his cypher and signe $-$, adde therefore thereto $2302584 + 0$ there shall thereof be made, as before, 2306500 , the pure Logarithme of his former value. So from the impure Logarithme $6358447 + 00$ if you subtract $4605168 + 00$, (which containeth as many cyphers) there shall remaine the pure Logarithme 1753278 , and of the same value, whereof that former, impure Logarithme was.

- 11 If to a Logarithme that is Defectiue in number, you shall adde any of the foresaid Logarithmes of the ninth Section, that is greater in number, there shall come forth a Logarithme of the same value Abounding in number.

As to the Logarithme $- 2859527 - 0000$ adde any of the numbers of the ninth Section, that is greater in number. As for example, $4605168 + 00$, and there shall bee made thereof $1745641 - 00$ of the same value, and Abounding in number.

- 12 You may giue the Sines, Tangents, and Secants, or any numerall values whatsoever, of the Logarithmes that are found in our Table by the 11. 14. 22. 25. 28. 30. Section of the 3 Chapter, whether

whether they be pure or impure.

As to the Logarithme of 36 degrees, 40 minutes 515572, in the third columnne, answereth his sine 597159 in the second columnne, & to the Defectiue therof — 515572 there answereth in the Table of Secants, 1674597, the Secant of 53 degrees, 20 minutes.

Also to the Differentiall Logarithme 295079 in the fourth columnne, answereth the Tangent 744472 in his Table, and to his Defectiue — 295079 answereth 1343233 the Tangent of 53 degrees and 20 minutes. So of the Logarithme 220493 in the fifth columnne, the numerall value in the sixth columnne is 802123, that is the Sine of 53 deg. and 20 min. and the numerall value of the Defectiue thereof, that is — 220493 is the Secant 1246691, agreeing to 36 degrees and 40 minutes.

An example of impure Logarithmes.

Let the value of the impure Logarithme 9780—0 be sought out; to this number, there answereth in our Table the Sine 990268, from which take the figure next the right hand (as — 0 doth shew) & they shall be made 99027, the value of the Logarithme 9780—0 which was sought. So the value of the Logarithme 2545177+00 is 7845900, because that to the pure Logarithme 2545177 there answereth in our table the Sine 78459. Also of the Logarithme — 34914—00 found in the fourth columnne at 46 degrees, the value shall be 10355, because the Tangent of 46 degr. is 1035530. So of the Logarithme — 635030—00 found in the third columnne at 32 degrees, the value

value is 18871, because the Secant of the complement of 32 degrees, that is of 58 degrees, is 1887080, whose two last figures next the right hand 80, are to be blotted out for ——— 00 adioyned to the Logarithme.

13 *To estimate the numerall values of the Logarithmes giuen, and not found in our Table.*

For common measuring, it is sufficient for the most part, to take for the Logarithme giuen, the numeral value of the Logarithme in the Table, that comes neereſt that, which is giuen. But if you deſire to come neerer the marke, increaſe or diminish in number the Logarithme giuen, by the 9 Section of this chapter, his former value remaining vntill it be either found in the Table, or become like enough to ſome Logarithme in the Table, and the value of this Logarithme found by the former Section, is that which we ſeek for. As for example, let the value of this Logarithme 2314972 + 0 be ſought, to which there is none found like or neere enough in the Table; but if you ſubtraſt from it 2302584 + 0, there ſhal be left 12388 almoſt, to which vnder 81 degr. there ſhall be found one that is neere, and like enough to it, that is, 12388, the Sine whereof 987688 found by the former Section, is the value of the Logarithme propoſed 2314972 + 0 which was ſought for.

An Admenition.

FOR this and the 2 Sect. of this chapter, we would haue you admoniſhed, that the Logarithmes of the numbers giuen, & contrariwiſe the numerall values of the Logarithmes giuen, when they are not found in the Table, are moſt exactly giuen by the way, by which

which the Logarithmes are made or resolved, which is that you descend from the line giuen by meanes Geometrically proportionall, vntill you come to the next lesse line in the Table. Likewise from the Logarithme heereof, in the Table, that you descend also by as many agreeable meanes Arithmetically: and the last of these shall be the Logarithme of the first of them, and contrariwise by resolution that you descend from the Logarithme giuen by Arithmeticallyall meanes to the next lesse Logarithme in the Table, and from the value of this in the Table likewise, that you descend, by as many meanes Geometricall and agreeable: and the last of these shall bee the numerall value of the first of those Logarithmes. But what Arithmeticallyall equalitie of difference agreeth and is fitting to euery continued Geometricall proportion, is a matter of no meane skil to finde out. Wherefore of these (if God will) we shall intreate hereafter more at large, when we shall handle the making of Logarithmes.

CHAP. V. *Of the most ample vse of the Logarithmes, and ready practise by them.*



F the Logarithmes of three proportionals, the middle Logarithme being giuen, and one extreame to finde the other extreame, or his proportionall, or arch by one doubling, or subtraction onely. I Probleme

Seeing that by the second proposition, Chap. 2. the double of the middle (Logarithme) made lesse by one of the extreames, is made equall to the other; Therefore from the

the double of the middle Logarithme giuen, subtract the giuen Logarithme of the extreme, and there shall remaine the Logarithme of the extreme that was sought for: which being found in the third, fourth, or fifth columnne of the Table, you have the arch answering thereto in the first and seventh columnne, and the Sine in the second or sixth, and their Secants or Tangents in their Tables, by the third Chapter, Section 1. 2. 6. 8. 11. 14. 22. 25. 28. 30. for the extreme that was sought for. *Example.*

$0:10:14$
 707107.45
 $10:346573$
 $10:693147$
 1000000
 1000000
 707107
 500000

LET the first proportionall giuen, bee 1000000, and the second 707107: let the third be sought for, which commonly is found by multiplying the middle number by it selfe, & diuiding this square by the first. But we find it easilier by doubling the Log: of the middle number 346573, and by subtracting from this double (wch is 693147) the Logarithme of the first, which is 0, & there remaineth 693147, the Logarithme sought for, whose arch you shall finde to be 30 degrees, and the Sine adioyning thereto 500000, which is the proportionall number sought for. Therefore 1000000. 707107. 500000, are three proportionall numbers, the last whereof wee found onely by doubling, and subtraction, which wee promised. Also let there bee two proportionall numbers giuen, the first 1056256, & 766045 the second, or at least their Logarithmes — 54730, and 266515. The third you shall thus finde: From the double of this last 533030 subtract — 54730, and by the 8 Section of the 4 chapter, there is brought forth 4587760, the Logarithme of 33 degrees. 45 minutes, the

fne

fine whereof 555570 is the third proportionall number that was sought for.

Out of the Logarithmes of three proportionals, Prpb. 2.
the extreame Logarithmes being given, to finde the middle Logarithme and his proportionall and arch, by one addition onely, and diuision by two.

Seeing by the third proposition of the second chapter, the double of the middle Logarithme is equall to the summe of the extreames, therefore adde the Log. of the extremes, and diuide the product by 2, & there shall come forth the Logarithme of the middle proportionall number: and thereby the middle proportionall, and the arch thereof, is knowne in the columnes, and by the Sections, as before. *As for Example.*

LEt the extremes 1000000 and 500000 be given, and let the meane proportionall be sought: that commonly is found by multiplying the extremes given, one by another, and extracting the square root of the product. But we finde it easilier thus; We adde the Logarithmes of the extremes 0 and 693147 , the summe whereof is 693147 which we diuide by 2 & the quotient 346573 shall be the Logar. of the middle proportionall desired. By which the middle proportionall 707107 , and his arch 45 degrees are found as before. Also let the extremes given be 1056256 and 555570 , their Logarithmes are 54730 and 587760 . The summe of these put together, is 533030 by the 5 Sect. Chap. 4. which we diuide by two, and the quotient is 266515 , the Logarithme and his arch 50 degr. and the fine or meane proportionall sought for is 766044 . found by addition onely, and diuision by two.

Prob. 3.

Out of the Logarithmes of foure proportionals, three being giuen, or their arches, to find the fourth Logarithme with the sine and arch thereof, by one addition onely, and subtraction.

In this problem wee alwayes make the thing demanded the fourth, so that as the first of the numbers giuen is to the second, so is the third to the number demanded. And seeing the summe of the Logarithmes of the second and third of the numbers so placed, diminished by the Logarithmes of the first, is equall to the Logarithme of the fourth, by the 4. Prop. Chap. 2. Therefore adde the Logarithmes of the second and third, and from the summe of them take the Logarithme of the first, and there shall remaine the Logarithme of the fourth proportionall number demanded, and thence the fourth number is selfe, and the arch thereof.

For examples sake.

AS 766044 is to 984808: so let 500000 be to the fourth proportionall which wee seeke for. This they commonly finde by multiplying the second and third, and diuiding the product by the first. But you may find it more easily thus: Adde the Logarithme of the second 15309, and of the third 693147, the summe whereof shall be 708456: out of which subtract the Logarithme of the first, which is, 266515, and there shall remaine 441941, the Logarithme of the fourth, whose sine 642788 is the fourth proportionall desired, and the arch thereof 40 degrees. The same would come forth if (the sines being neglected) their three arches onely were giuen 50 degrees, 80 degrees, and 30 degrees. For out of the Logarithms of the arches 80 degrees,

degrees, and 30 degrees, subtract the Logarithme of 50 degrees, there shall remaine the Logarithme of 40 degrees: and so the arch it selfe 40 degrees, shall be knowne without the sines, or their multiplication or diuision, according as we promised in the beginning.

Another Example.

AS the Tangent of 43 degrees is to the Sine of 57 degrees, so let the Tangent of 35 degrees bee to a fourth Sine vnkowne, whose arch without regard either of Sines or Tangents, we shall thus finde: Wee adde the Differential Logarithme of 35 degrees, that is, 356378 found in the middle columnne to the Logarithme of 57 degr. that is 175937 placed in the fifth columnne from the product, that is, 532316, wee subtract the Differential of 43 degrees, which is 69870, and there remaineth 462446, the Logarithme of the fourth (Sine) which being found in the third columnne, by the 11 Section of the third chapter, you shall finde close by it in the first columnne 39 degrees 2 minutes almost, which is the arch of the fourth proportionall, or Sine neglected.

Thus the arches of proportionall numbers are found without their Sines, Tangents, Secants, or any proportionall numbers whatsoever.

Which so short a way of working, doth helpe very much for measuring the angles of plaine triangles, and for the whole *Trigonometrie* of spherical triangles, as in his proper place shall appeare.

Of foure numbers in continuall proportion, the extremes being giuen, or their arches, to finde any Prob. 4.

of the middle numbers, or any of their arches, onely by diuiding by three, instead of the troublesome extracting of the cubicke root.

Seeing that in the Logarithmes of these, the triple of any middle one, is equall to the summe of the extreme remoued, and the double of the next extreame, by the sixth proposition of the second chapter. Therefore adde the double of either extreame Logarithme to the Logarithme of the extreame remaining, and diuide the product by three, and there shall come forth the Logarithme of the middle proportionall next the former extreame, and after the same manner, the other meane proportionall also.

As for examples sake.

Let the first extreame be 402925, and the last, 1056256, the meane proportionals are sought for, which without extraction of the cubicke roote you shall thus finde. The Logarithme of the numbers giuen are 909005, and — 54730: to the double of that 1818010, adde this, and the summe shall bee 1763280, which diuided by three, bringeth forth 587760 the Logarithme, whose Sine 555570 is the first meane proportionall sought for. Also in like manner to the double of this — 54730, which is — 109460, adde that 909005, and the product will bee 799545, which diuided by three, bringeth forth 266515 the Logarithme, whose Sine 766044 is the later meane which was sought for. These therefore are foure continuall proportionals 402925, 555570, 766044 and 1056256.

Another example.

Let the extreames giuen bee 1414213, and

and 500000: the first of these being found in the Table of Secants, the Logarithme thereof in our Table is —346573, and the Logarithme of 500000 is 693147 to the double whereof, 1386294 adde —346573, the summe shall be 1039720, which diuided by 3, will be 346573 the Logarithme of the meane proportionall next the lesse extreme, which is 707107. So to the double of —346573, which is —693147, add 693147, and there shall be made thereof nothing, which diuided by 3, maketh also 0, the sine and the value whereof is 1000000 for the remaining and greater meane proportionall. These foure therefore are continually proportionall, 141413. 1000000, 707107. 500000.

The Conclusion.

NOW out of this that is already deliuered; let the learned iudge how great benefit the *Logarithmes* bring them; seeing that by the addition and subtraction of them, and by diuiding by 2 and 3. and by other easie additions, or subtractions, multiplication, diuision: the extraction of the square and cubicke rootes, and all the great toyle of calculating is auoided, a generall taste whereof we haue giuen in this Booke.

But in the booke following we shall treat of their proper and particular vse in that noble kinde of *Geometrie* which is called *Trigonometrie*.

The end of the first Booke.

$$\begin{array}{r}
 693147 \\
 \hline
 1386294 \\
 346573 \\
 \hline
 1039721
 \end{array}$$



THE SECOND BOOKE.

Of the excellent Use of the admirable Table of Logarithmes in Trigonometric.

CHAP. I.



SE EING that *Geometrie*, is the Art of measuring well, and measuring belongeth to Magnitudes, and Magnitudes are Figures, (at least in power) and a Figure is either a Triangle, or Triangled, and that which is triangled, is compounded, or made of Triangles: which, and whose parts, being measured, that figure also, and all the parts thereof will bee measured. It is therefore certaine, that the Arithmetical solution of any Geometrical question, dependeth on the doctrine of Triangles. A Triangle is either right-lined or spherical.

Of Right-lined Triangles.

*Propos. I.
prima*

The three Angles of a right-lined Triangle, are equall to two right Angles.

Therefore if two angles be giuen, take the summe

summe of them out of 180 degrees, and there will come forth the third angle. Also one angle being taken out of 180 degr. the summe of the other two remaines.

A Right-lined Triangle is either right-angled, or obliquangled. In right angled triangles wee call the sides that are about the right angle, Leggs; and that which subtendeth the right angle wee call the Hypotenuse.

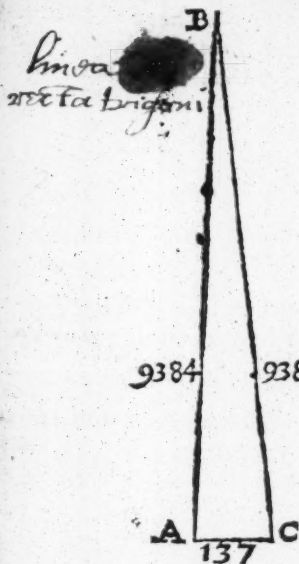
In a right-angled triangle the Logarithme of the Propos.^d legg, is equall to both the Logarithme of the angle *founda* opposite thereto, and the Logarithme of the Hypotenuse.

Seeing it is manifest out of the principles of *Trigonometrie*, that either legg hath the same proportion to the sine of the angle opposite thereto, that the Hypotenuse hath to the whole sine: and (by the fifth proposition of the second chapter of the 1 book) the Logarithmes of the second and third of these foure proportionals are equall to the Logarithmes of the first and fourth: and the Logarithme of the fourth is 0, or nothing (y the Corollarie of the sixth definition of the first Chapter, and first Booke.

Therefore (as before) the Logarithme of the legge is equall to the summe of the Logarithme of the angle which it subtendeth, and the Logarithme of the Hypotenuse.

Therefore any two of the Hypotenuse, A Consequent legg, and angle which it subtendeth, quent. being giuen: the third, and thence all the rest of the parts of a right angled triangle will be knowne.

Because these three, with the whole sine,
C 4 make



make foure proportions, it is certaine that any of them may be put in the fourth place, and so be found out by the 3 *Probl.* of the 5 *Chap.* of the 1 Booke.

As in the triangle A B C right angled in A.

let the Hypotenuse B C be given ——— 9385

with the leg A B ——— 9384

The oblique angles C and B are sought for.

Therefore out of the Logar. of A B 63587—00

take the Logar. of B C 63480—00. There re-

maines 107. The Logarithme of the Angle C,

whereto there answereth in the Table 89 degrees, $9\frac{3}{4}$ for the angle C, and overagainst it 0 degr. $50\frac{1}{4}$ for the complement thereof, namely the Angle B.

Contrariwise, if the Angle C be given, with the legge of the right angle A B, and the Hypotenuse B C be sought for.

Out of the Logar. of A B. + 63587—00

Take the Logar. of the angle C + 107

And there will come forth — + 63480—00 the Logarithme of B C 9385 the Hypotenuse that was sought for.

Thirdly, if B C and the angle C being given, and A B be sought for,

Adde the Logarithme of B C + 63480—00 to the Logar. of the angle C + 107

And

CHAP. I. The second Booke. 33

And there will be brought forth 3367—00 the Logarithme of the number 9384, answering to the legge A B, which was sought for.

No otherwile is the legge remaining A C found by the angle B. (which is the complement of the angle C) already knowne. And so all the parts of this right-angled triangle are knowne.

*In a right angled triangle the Logarithme of Propos. 3.
any legge is equall to the summe of the Differenti-
all of the opposite angle, and the Logarithme of the
leg remaining.* *Lemma*

Seeing it is manifest out of the common doctrine of Triangles, that either legge hath the same proportion to the Tangent of the angle opposite thereto, that the other hath to the whole sine: and seeing that (by the 5 proposition of the second chapter of the first Booke) of these foure proportionals, the Logarithmes of the middle ones, that is to say, the Differential of the angle, and the Logarithme of the legge including it, are equall to the Logarithmes of the legge subtending the same, and of the whole sine, (which is 0, or nothing) therefore the Logarithme of the legge is equall to the summe, &c. as before.

*Therefore of the legges of the right angle, and Corollarie.
the angle opposite to one of them, any two being
given, the third is knowne (by this Prop.) and there-
fore all the other parts of the right angled triangle
by the former proposition.*

Because these three, with the whole sine, doe make foure proportionals, it is certaine that euery one of them may be placed in the fourth place, and bee found out by the third Prob. of the 5 Chap. of the first Booke.

As

34 *The second Booke.* CHAP. I

As in the triangle going before A B C, right angled at A: the leggs A B being giuen 9384, and A C 137, let the angle B be sought out.

From the Logarithme A C $+4292453-00$
Subtract the Logar. of A B, $+63587-00$

And there will come forth $+4228866$ the
Differentiall of the angle B, 0 deg. 50. 11.
which was sought for.

But if the legg A C be giuen 137, and the
angle B, 0 deg. 50. 11, the legg A B, shall be
thus found.

Out of the Logarithme of A C $+4292453-00$
Subtract the Differential }
of the Angle B } $+4228866-00$

the number comming thereof $+63587-00$
is the Logarithme of the number 9384 which
is the legg sought for A B.

Thirdly, the legg A B being giuen 9384,
and the angle B, 0 deg. 50. 11. that the legg
A C may be found,

Adde the Logar. of the leg A B $+63587-00$
to the Differ. of the angle B $+4228866$

and there will come forth $+4292453-00$
the Logarithme of 137 the legg A C, which
was sought for.

The Hypotenuse B C is found by the for
mer proposition. Also the angle C is knowne,
because it is the complement of the angle B,
already knowne. And so by this, and the for
mer proposition, by any side, and any other
part of a right-angled triangle giuen, all the
other parts thereof are made knowne.

You haue therfore the knowledge of right-
angled right-lined triangles accomplished :
Now of oblique angled triangles.

Of Right-lined Triangles, especially obliquangled.

CHAP. II.

IN any Triangle: the summe of the Logarithmes of any angle and side inclosing the same, is equall to the summe of the Logarithmes of the side, and the angle opposite to them. Propos. 4. uacua

Because, there is the same proportion of all the sides to the sines of the opposite angles: and so the product of the right sine of any angle, & any side including the same, is equall to the product of the side subtending the former angle, and the sine of the angle subtended by the first side. Therefore by the 5. Prop. 2. Chap. 1. Booke. the summe of the Logarithme, &c. is equall, as before.

Therefore, of two angles whatsoever of a kinde Corola. is. giuen, and their subtendants: if three be giuen, any fourth will be knowne, and thence all the other parts of the triangle.

For of these foure proportionals, any that is sought for, may be put in the fourth place, & be found out by the third Prob. Chap. 5. Booke 1.

As of the obliquangled Triangle ABC, let AB be giuen 26302, and BC 57955; and the angle C 26 degrees: and let the angle A be sought for, which is thus found.

Adde the Logarith. of BC $+545471-0$

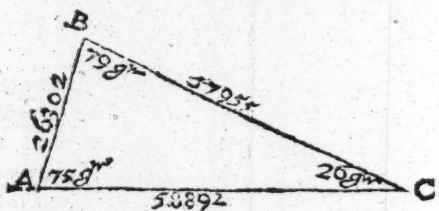
To the Logar. of C. 26. deg. $+824689$

And there will bee made $+1370160-0$

From thence take the $+1335492-0$

Logarithme of AB, $\} +1335492-0$

There remaines $+34668$ the Loga.



Logarithme of 75 degrees, and a little more
 w^{ch} is the angle A sought for: if A appeare to
 be an acute angle, otherwise 105 deg. (by the
 1 and 2 Sect. chap. 3. book. 1.) if it appeare to
 be an obtuse angle.

Contrariwise, if the angle A bee giuen 75
 degr. and the angle C, and the side B C as
 before, and A B be sought for.

Adde the Logarithme of B C $+ 545471-0$
 to the Logar. of the angle C $+ 824689$

they will be made as afore $+ 1370160-0$

From which take the } $- + 34667$
 Logar. of the angle A }

There will come forth $+ 1335492-0$ the
 Logarithme of the side A B, and the number
 thereof 26302, which was sought for.

The angles A 75 degr. and C 26 deg. being
 now found, the angle B shal be 79 deg. (by the
 1. Prop. of this book :) out of which being now
 found, the side opposite thereto A C 58892 is
 no otherwise found then the side opposite
 thereto (A B) was lately found by the angle
 C. Therefore now all the parts of this oblique-
 angled triangle are knowne.

In the obliquangled triangles, we call them logs
 which

which are about any angle, & the base which subtendeth the same.

In obliquangled triangles, the Logarithme of the Propos.^s summe of the legges, subtracted from the summe ^{quinta} made of the Logarithme of the difference of the legs, and the Differentiall of halfe the summe of his opposite angles, leaueth the Differentiall of halfe the difference of the same.

Because as the summe of the legges is to the difference of the legges; so is the Tangent of halfe the summe of their opposite angles to the Tangent of halfe the difference of the same: Therefore they are proportionall, and by the 1 Prop. 2. Chap. 1 Book. the differences, or excesses of their Logarithmes are equall. Therefore (by the 4. Prop. 2. chap. 1. book) we must necessarily conclude as before.

Therefore by two legs, and the angle contained betweene them, are knowne by this Proposition, the other opposite angles, and thereby the other side, by the proposition going before. *A Corollarie*

For the Logarithme of the summe of the legges being subducted out of the summe made of the Logarithme of the difference of the legges, and the Differentiall of halfe the summe of the opposite angles put together, there shall come forth the Differentiall of halfe the difference of the same angles; which halfe difference being added to the halfe summe aforesaid, there shall come forth the greater angle; and being subtracted, the lesse.

As in the foresaid Obliquangled triangle ABC

Let there be giuen AB one legg 26302

BC th'other leg 57955

B the angle contained
betweene them, 79 degrees, and let the other
angles

angles A and C be sought for.

The summe of the legges AB, and BC is 84257, the Logar. thereof 2473882, and the difference of the same AB and BC is 31653 the Logar. thereof 3452921. And seeing the angle B is giuen 79 deg. (by the first of this book) the summe of the angles A and C will be 101 degr. and halfe the summe 50 deg. 30. the Differentiall wherof is — 193177

Which being added to the Logarithme of the difference of AB, and BC ————— } 3452921

There wil arise ————— + 3259744

Out of which subtract the Logarithme of the summe of the legs AB and BC ————— } 2473882

There will remaine ————— + 785862
the Differential of 24 deg. 30, which are the halfe-difference, of the angles A and C that were sought for.

Therefore adde this half-differ. 24 deg. 30.
to the halfe summe. ————— 50 deg. 30.

And they will make ————— 75 deg. 0. for
the angle A, the greater of the angles sought for.

And out of the ————— 50 deg. 30.

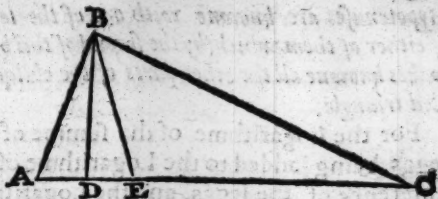
Subtract the same ————— 24 deg. 30.

And there will remaine ————— 26 deg. 0. for
the angle C, the lesse of the angles sought for.

A Definitio In obliquangled triangles, the true base is alwayes, either the sum of the cases (& then the difference of the cases is called the Alterne base.) or the true base is the difference of the cases, & then we call the summe of the cases, the Alterne base.

As in the Triangle ABC.

The



The lesse case is AD

The greater case is DC

The sum of the cases AC , is the true base

And in this triangle take the lesse case AD ,

or that which is equall to it DE ,

from the greater case DC ,

and there will remaine EC ,

the difference of the cases which we call the *Alterne base*.

Contrariwise, in the triangle EBC ,

The lesse case is DE (Whereto

AD is equall)

The greater case is DC

The difference of the cases EC is the true base

But the sum of the cases, that is, AC , wee call the *Alterne base*.

In obliquangled triangles, the summe of the Logarithmes of the summe, and difference of the legs Propos. 6. is equall to the summe of the Logarithmes of the *Alterne* true and *Alterne* bases.

Because the true base is to the summe of the leggs, as the difference of the leggs is to the *Alterne base*; therefore (by the 5. Prop. 2. Chap. 1. Book.) we necessarily conclude, that the Logarithmes of the bases are equall to the Logarithmes of the summe, and difference of the leggs, as before.

Therefore, of an obliquangled triangle, whose sides are giue, 2 right angled triangles are made, whose Hypo-

A Corolari

Hypo-

Hypotenuses are knowne with one of the legges of either of them, which (by the second of this booke) makes knowne all the other parts of the obliquangled triangle.

For the Logarithme of the summe of the legges being added to the Logarithme of the difference of the legges, and the Logarithme of the true base being taken from hence, there will come forth the Logarithme of the Alterne base (by the 4. Prop. of the 2 Chap. and 3. Problem of the 5. Chap. of the 1 Booke.) Therefore halfe the summe of these bases is the greater case, and the halfe-difference is the lesse case.

As in the former triangle A B C,
Let the sides be giuen, that is to say,

The legge A B 26302

The legge B C 57955

and the true base A C 58892 and let the rest be sought for.

The summe of the legges is, 84257

the Logarithme thereof is — + 2473882

The difference of the legs is, 31653

and the Logar: thereof is, — + 3452921

Adde these Logarithmes together, and they will make, } — + 5926803

From which take the Log: of } — + 2831930

the true base A C ————— + 3094873

There remains the Logarithme of the number of the Alterne base E C ————— 45236

which add to the number of the true base A C. } — 58892

And there remaines ————— 104178

The halfe whereof D C ————— 52089

is the greater case.

Subtract one out of another, viz.

Out

Out of the true base A C 58892

Take the Alterne base E C 45286

And there remains- ——— 13606

The halfe whereof A D. }
is the lesse case. ——— } 6803

Therefore of the right-angled triangle A D B, the Hypotenuse A B, and one of the legs A D being found : and of the right angled triangle B D C the Hypotenuse B C, and the leg D C being found (by the second of this chapter) the angles of the right angled triangle at A, and B, and C, are known, and by by consequent, also all the parts of the obliquangled triangle proposed, are manifested by the premises. Neither should you doe otherwise if the sides of the triangle E B C, were giuen, and the other parts were sought. For out of the legges, and the true base E C, the Alterne base A C is knowne, and out of these both cases, and the rest, as before.

The Conclusion.

NOW therefore, you haue the doctrine of all right-lined triangles perfected & accomplished, which if it seeme somewhat toylesome in finding out the Logarithmes of variable right-lines; yet in calculating the motions of the planets, (in which the excentricities of the Orbs, the distances of the Auges & Apogæ; the diameters of the Epicycles and other right lines, remaine the same, and invariable) their Logarithmes being once exactly set downe, shall alwayes serue after-wardes without any changing, with maruailous facilitie and certaintie.

Now

Now, there followes the Sphericall triangles, which are most hard, as they are commonly deliuered by others; but by our Logarithmes they are the most easie of all.

Of Sphericall Triangles
CHAP. III.

Sentences



N Sphericall triangles, the angle that is neereſt in quantitie to a quadrant, and the ſides ſubtending the ſame, are doubtful whether they be of the ſame, or of a diuers kind, except the account, or poſition bewray the ſame.

- 2 But every one of the two oblique angles, is of the ſame kinde with the ſides ſubtending the ſame. Therefore knowing of what kinde the one is, it appeareth alſo of what kinde the other is.
- 3 If any angle of a triangle bee neerer to a quadrant then the ſide ſubtending the ſame: two ſides thereof ſhall be of one kinde, and the third leſſe then a quadrant.
- 4 But if any ſide of a triangle be neerer to a quadrant then the angle ſubtended thereby, two angles thereof ſhall bee of the ſame kinde, and the third greater then a quadrant.
- 5 A Sphericall triangle, is either quadrantall or not.
- 6 A quadrantall, is that whoſe ſide or angle is equall to a quadrant: whereby we teach, that the knowledge of a quadrantall that is not right angled may as eaſily be gotten, as if it were right angled.
- 7 A quadrantall triangle, is either manifold, or ſingle.
- 8 A manifold quadrantall, is either three right angled

angled, or two right angled.

A three right angled triangle, is that, whereof every part is equall to a quadrant.

Therefore euery triangle, each of whose three parts not being opposite, are equall to a quadrant, is three right angled.

A two right angled triangle, is that whereof two angles onely, and the sides subtending them, are severally equall to a quadrant.

In euery two right angled triangle, the oblique angle, is equall to his subtending side.

Euery triangle, whereof any part is equall to a quadrant, and any oblique angle, equall to his subtendant, is two right angled.

Euery triangle hauing any two parts severally equall to a quadrant, and the third vnequal, is two right angled.

All the rest are called single quadrantals.

Of Single Quadrantals.

CHAP. IV.

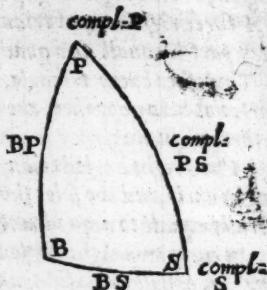


Single Quadrantall, is that whereof one part onely is equal to a quadrant, and the other five parts are not quadrants.

Of these five parts which are not quadrants, those three which are furthest removed from the right angle, or the side that is a quadrant, we turne into their complements, and retaining the old order, we bring them all five into a circular, or quinquangled situation, and wee call them Circulars.

First let the triangle B P S be right angled in B, the five oblique parts therof which are not quadrants are these, B P, one of the sides about the

the right angle: P
 one of the oblique
 angles: P S the
 side subtending
 the right angle: S
 the other oblique
 angle: S B the o-
 ther side about
 the right angle,
 for which we (for
 the easier calcula-
 tion) take the side



it selfe B P: the complement of the angle P:
 the complement of the side P S: the com-
 plement of the angle S: and the side it selfe
 S B, and keeping their naturall situation, we
 place these five parts in order, as in the mar-
 gine, and we call them Circulars.

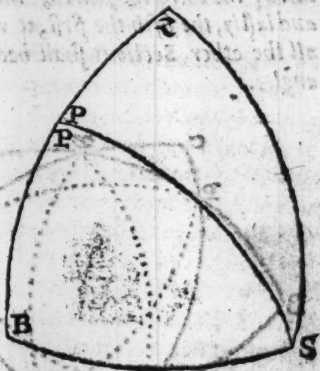
Likewise secondly, let S P Z be a quadrantal single triangle, not right angled (made of the centers of the Sunne-rising, the pole and the zenith) quadrantall in the side Z S, his five parts not quadrants are these, Z one of the angles compassed by the quadrant side: P Z the distance of the pole from the zenith: P the angle subtended by the quadrant: the side P S the distance of the pole from the Sunne: And lastly S one of the angles, about which the quadrant is: in stead wherof we for our easier account do take the angle Z or P Z S, being adioyned to a quadrant, and



is the arch of the Sunnes distance from the North. The complement of $P S$ which is the elevation of the pole: the complement of the angle P , or of the angle $Z P Z$ which is the difference ascensional (that is) the difference of the time of the Sunnes rising or setting from sixe a clocke.

The complement of the side $P S$, which is the declination of the Sunne: and the angle it selfe S , or $P S Z$, which wee call the angle of the Sunnes position (that is in respect of the Pole and Zenith.) These five parts we place in a circular or pentagonall site, as in the margine, and we call them Circulars, neither shall there be made any other circular parts of the former right angled triangle $B P S$, if you make P

the Pole: S the Sunne: B the North-point: for the side $B P$ will be the elevation of the pole: the complement of P the difference ascensional: the complement of $P S$,



the declination of the Sun: the complement of S the angle of the Sunnes position: and lastly, $B S$ the Azimuth of the Sunne, which are altogether the same circular parts that were before, and placed in the same site towards the left hand that the other was towards the right.

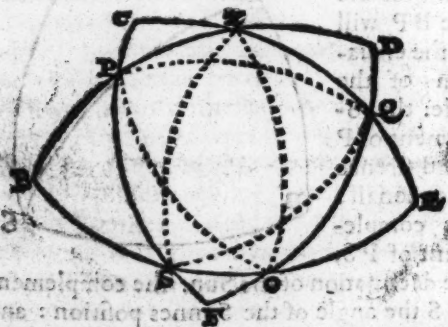
And

And so in all quadrantals, as well right-angled, as not.

Corolarie. 3 Hence it is that there bee many triangles, not conformable in their naturall parts, which in these Circular parts, doe altogether agree, and are resolved by this our methode of Circulars.

As it clearly appeareth in the two former triangles B P S, and P Z S ioyned together: In which all the naturall parts (besides P S and B S of the former, and P S, and P Z S of the latter, do altogether differ, but all the Circular parts agree, as is aforesaid.

4 This uniformitie of the Circular parts, most manifestly appeareth in right-angled triangles made on the superficies of a globe, of five great circles, the first whereof cutteth the second, the second the third, the third the fourth, the fourth the fifth: and lastly, the fifth the first, at right angles. But all the other Sections shall bee made at oblique angles.



For example sake: the meridian of any region D B cuts the Horizon B E, in the poynt B. The Horizon B E cuts the circle E C, which compasseth about the Sunne (that is to say, which

which is drawne about the Sun as his pole) in the poynt E. The circle E C, which compasseth the Sunne, cuts the meridian of the Sun C F in the poynt C. The meridian of the Sun C F cuts the Equator F D in the poynt F. And lastly, the Equator F D cuts the meridian (of that region D B) in the poynt D. And all these five Sections in the poynts B, E, C, F, D, are made orthogonally and at right angles. The other Sections in the points Z, P, S, O, Q, being made at oblique angles. There will also bee made of these Sections five right-angled triangles, PBS , SFO , OEQ , QDZ , and ZCP , the naturall parts whereof, although they differ, and are varied in each severall triangle, yet the five Circular parts are the same that were before without any difference.

The same uniformitie of the circular parts appeareth also in quadrants that bee not right-angled, made upon the superficies of a Globe out of five poynts, the first whereof is distant from the second, the second from the third, the third from the fourth, the fourth from the fifth, and the fifth from the first by distances and arches equall to a quadrant; but the other distances of the poynts bee unequall to a quadrant. As in the same figure the poynts P from Q, Q from S, S from Z, Z from O, and O from P, are distant by spaces equall to a quadrant. But P from Z, Z from Q, Q from O, O from S, and S from P, are distant each from other by arches which are not quadrants. There will also bee made out of these distances, five quadrants not right-angled, PZQ , ZQO , QOS , OSP , and $SOPZ$, whereof although the naturall parts differ, yet the circular parts remaine the same

same vncchangeable here as before, that is to say: BP the eleuation of the pole: the complement of BPS , or SPZ , the difference ascensionall: the complement of PS , which is SF , the declination of the Sunne: the complement of PSB , which is PSZ , the angle of the Sunnes position: BS the Azimuth of the Sunne, which doe indifferently agree to all the former triangles, and not to those alone, but also to all triangles which do arise of the other intersections of these ten arches drawn forth, to whole circles, which because they are many, and confused, we here let them passe, it is sufficient to haue warned by this abridgement, that all the confusion of the naturall parts, and of their rules is annoyded, and taken away by these few Circular parts, and their onely rule.

6 *Of the five circular parts three alwayes come in question: whereof the two first, are giuen, the third is sought for.*

And of these three, one is in the middle, and two are the extreames which are either set about the middle, or opposite to it.

For example sake. Let the three parts proposed in the question be these: the Azimuth of the Sunne BS : the eleuation of the Pole BP : and the ascensionall difference the complement of BPS , whereof the eleuation of the pole is called the middle, and the other two extreames are called neighbours vnto it, or set about it. But if the three parts coming in question were: the declination of the Sun. the complement of PS : the eleuation of the Pole BP : and the angle of the Sunnes position PSZ , the eleuation of the pole shal be called the middle one, as before, but the declination

clination of the Sunne, and the angle of the Sunnes position, shall bee called the extremes, remoued from the middle, or opposite to it. The like reason is in the other five.

The Logarithme of the middle one is equall to the Differentials of the extremes set about it, or to the Antilogarithmes of the opposite extremes.

This Theorem is proued by induction of all the three parts or triplicities which can be made, and come into question of the five circular parts of the former right-angled quadrantal B P S. But wee omit the triplicities of the latter triangle not right-angled P Z S. because all the circular parts thereof are altogether the same in quantitie which were in the former (by the 3. 4. and 5. of this chapter.) Now therefore of the five circular parts of the right-angled triangle B P S, (which are B S, or the Azimuth of the Sunne rising; the complement of B S P, or the angle of the Sunnes position: the complement of B P, or the declination of the Sunne; the complement of S P B, or the difference ascensional; and P B, or the eleuation of the pole) The 3 which come in question of extremes, set about the middle one, are either first B S, the complement of B S P, and the complement of S P: or secondly the complement of B S P, the complement of S P, and the complement of S P B: or thirdly, the complement of S P, the complement of S P B, and P B: or fourthly, the complement of S P B, P B, and B S: or fifthly, P B, B S, and the complement of B S P.

But because in all these triplicities, the Tangent of one of the extremes is to the right sine of the middle one, as the whole sine is to Tangent of the

the other extreame (as it is manifest out of the common demonstrations of Trigonometrie) therefore by our demonstrations of the 5. Prop. of the 2. Chap. 1. Book. the Logarithmes of the middle ones (which are the Logarithme of the middle one onely, by the Corollarie of the sixt definition of the first cha. 1. Book) are equall to the Tangents of both the extremes. But the Logarithmes of the Tangents of these extremes are the Differentials of the same (by the 22 and 5 Sect. Chap. 3. Booke 1.) Therefore the Logarithme of the middle one only, is equall to the Differentials of the extremes set about it, as we said in the former part of the Theorem. The confirmation of the latter part followeth.

Therefore of the same five circular parts the three which come into question of the extremes opposite to the middle one, are either, first PB the complement of BSP , and the complement of SPB : or secondly, BS the complement of SP and PB : or thirdly, the complement of BSP , the complement of SPB and BS : or fourthly, the complement of SP , PB , and the complement of BSP : or fifthly, and lastly the complement of SPB , BS and the complement of SP .

But in all these triplicities, or five cases, the right sine of the complement of one of the extremes is to the right sine of the middle one, as the whole sine is to the right sine of the complement of the other extreame (which is more largely demonstrated by Regiomontanus, Copernicus, Lansbergius, Pitiscus, and others: then that it can be repeated in this abridgement) therefore by our demonstrations (the 5. Prop. 2. Cha. 1. Book the Logarithmes of the complements of these extremes, are equall to the Logarithmes

the middle ones, that is (as is aforesaid) to the Logarithme of the middle one onely.

But the Logarithmes of the complements of these opposite extreames, are the Antilogarithmes of the very same parts, out of the definition. Sect. 13. and 16. Chap. 3. Book 1. Therefore it followeth in these cases, that the Logarithme of the middle one only is equal to the Antilogarithmes of his opposite extremes, as the latter part of the Theore^m affirmeth. Therefore the whole Theorem is manifest. Beside this prooffe now made by induction of all the cases which can happen, the same Theorem may bee also clearly perceiued by the 4 and 5 of this chapter, in the figure whereof, the like constitution of the circular parts doth argue the similitude of the analogie of the same. So that whatsoever may be truly said of any middle one, and his extreames set about, or opposite, the same cannot iustly be denied of the other foure middle ones and their extreames respectiue^{ly} set about, or opposed.

A generall Consequent.

Hence it followeth in single Quadrants, 9
that out of any two parts giuen, any third shall be found. For alwayes either the middle one is sought for, & his Logarithme is found by adding the Differentials of the giuen extreames set about, or one of the extremes is sought for & his Differential ariseth out of the subtraction of the Differential of the other extreme giuen out of the Logarithme of the middle one already knowne, as in the five former triplicities of a right-angled triangle of the Theorem going before, and as many of a not-right-angled triangle: or else the middle

one is sought for, and his Logarithme com-
meth forth by adding the Antilogarithmes
of the opposite extreames giuen. Or lastly,
one of the opposite extreames is sought for,
and his Antilogarithme is found by subtra-
ction of the Antilogarithme of the other op-
posite extreme already giuen out of the Lo-
garithme of the middle one already knowne.
*As in the five latter cases of the right angled trian-
gle of the Theorem going before, and as many of a
not-right-angled triangle. But to every one of
these Logarithmes, Antilogarithmes and Diffe-
rentials already found, there answere two arches
of diuers kindes. Therefore out of the kinde of the
arch sought for, knowne by the 2. 3. or 4. of this
chapter, or else by position, the true arch it
selfe shall be made knowne.*

As in the former example of the seuenth
Section of this Chapter, three parts of the
question are Circular, The Azimuth of the
Sunne, the Elevation of the Pole, the Difference
Ascensionall: that is, in the right-angled tri-
angle B P S, the parts are B S and P B, and the
complement of S P B: or else in the not-right-
angled triangle quadrantall P Z S, the parts
are P Z S, the complement of P Z, and the
complement of S P Z, of which three let the
extreames set about be giuen, that is, The A-
zimuth of the Sunne rising B S, or P Z S, 70 de-
grees, and the difference Ascensionall the comple-
ment of P B, or the complement of S P Z, 16
deg. 24' and the middle part P B, be sought,
or the complement of P Z, which is the Ele-
uation of the Pole.

Let the differentiaall therefore of the com-
plement of S P Z 16 deg. 24' 27. + 1222618
Bee added to the Differentiaall of B S, or
B Z S

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B Z S 70 degr. ————— 1010683

And there will come forth + 211935 the
Logarithme of B P 54 deg. for the eleuation
of the pole sought for.

An Admonition.

Besides the *Elevation of the Pole* thus now
found, there is also found by the same ma-
ner of working.

2 The *Azimuth of the Sunne* by the eleuation
of the pole, and the angle of the Sunnes po-
sition giuen.

3 The *Angle of the Suns Position* out of the A-
zimuth of the Sun, and his declination giuen.

4 The *declination of the Sunne* out of the an-
gle of the Sunnes position, and the difference
Ascensionall giuen.

5 The *Difference Ascensionall* out of the Decli-
nation of the Sunne, and Eleuation of the
pole giuen.

The second Example.

Let the *Azimuth of the Sun rising* bee giuen
B S, or P Z S 70 degr. and the *Elevation of
the Pole*, 54. degr. which is P B, or the comple-
ment of P Z : and let the *Difference Ascen-
sional* be sought, that is, the cōplement of S P
B, or the complement of S P Z. And because
here likewise the extreame parts are set a-
bout the middle part, therefore

Take the Differentiall of the Suns Azimuth,
B S, or B Z S 70 deg. which is — 1010683

Out of the Log. of the eleua- } + 211935
tion of the Pole B P, 54. deg. }

And there will come forth — 1222618 the
Differentiall of S P B 16 deg. 24. 27. the arch
of the *Ascensionall difference* sought for.

An Admonition.

IN imitation of this example there is found
 1 *The Declination of the Sunne* out of the difference Ascensionall, and the Eleuation of the pole giuen.

2 *The Angle of the Sunnes position* out of the declination of the Sunne, and Difference Ascensionall giuen.

3 *The Azimuth of the Sunne* out of the angle of the Sunnes position, and the declination of the same giuen.

4 *The Eleuation of the Pole* is had out of the Sunnes Azimuth, and the angle of the Sunnes position giuen.

Also contrariwise there is found

5 *The Difference Ascensionall* out of the declination of the Sunne, and the angle of the Sunnes position giuen.

6 *The declination of the Sunne* out of the angle of the Sunnes position, and his Azimuth giuen.

7 *The Angle of the Sunnes Position* is had out of the Azimuth of the Sunne, and the Eleuation of the pole giuen.

8 *The Azimuth of the Sunne* out of the Eleuation of the pole, and the Difference Ascensionall giuen.

9 And lastly, *the eleuation of the Pole* is found out of the difference Ascensionall, and the Declination of the Sunne giuen.

The third Example.

IN the latter example of the same 7th Section of this chapter, these three circular parts of the question are propounded, *The Declination of the Sunne, the Eleuation of the Pole*

Pole, and the Angle of the Sunnes position. These in the right angled triangle B P S, are the complements of P S, B P, and the complement of B S P. And in a not-right-angled quadrantall P Z S, they are the complement of P S, Z P, and Z S P. Of which three let the opposite extreames be giuen, that is, *the Declination of the Sun*, which is the complement of P S 11 deg. 35. 51. and *the angle of the Sunnes position*, which is the complement of B S P, or Z S P 34 deg. 19. 21. almost. And let the middle part B P be sought, or the complement of Z P, *which is the eleuation of the Pole.* Therefore

Let the Antilog. of the complement of P S
 11 deg. 35. 51. which is ——— + 20627
 be added to the Antilog. 2 + 191308 and
 of B S, 34. deg. 19. 21 > —————
 there will come forth ——— + 211935 the
 Logarithme of B P 54 deg. for the *Elevation*
of the pole that was sought for.

An Admonition.

BESIDES the Eleuation of the pole now first found after this manner, you may by the same practise haue

- 2 *The Azimuth of the Sunne* out his declination and the difference Ascensionall giuen.
- 3 *The angle of the Sunnes position* out of the difference Ascensionall, and the Eleuation of the the pole giuen.
- 4 *The Declination of the Sunne* out of the Eleuation of the pole, and Azimuth of the Sun giuen.
- 5 And lastly, you shall finde *the Difference Ascensional* out of the Azimuth of the Sunne, and the angle of the Sunnes position giuen.

The fourth Example.

Let the Declination of the Sunne bee giuen the complement of SP 11 degr. 35. 51. And the Eleuation of the pole BP, or the complement of PZ 54 degrees. And let the angle of the Sunnes position the complement of B S P, or P S Z be sought for. And here likewise, because the extreame parts are opposed to the middle, therefore

Out of the Log. of BP 54 deg. $+ 211935$

take the Antilog. of the com- $+ 20627$

plement of P S 11. deg. 35. 51. $\frac{5}{\text{—————}}$

and there will remaine $+ 191308$ the Antilogarithme of the complement of B S P. 34. deg. 19 21. almost, the angle of the Position of the Sunne sought for.

An Admonition.

Besides the angle of the Sunnes position found out by this first practise, there is found

2 By the same practise the Declination of the Sunne, out of the difference Ascensionall, and the Azimuth of the Sunne giuen.

3 The Difference Ascensionall is found out of the Eleuation of the pole, and angle of the Sunnes position giuen.

4 The Eleuation of the pole is found by the Sunnes Azimuth, and his declination giuen.

5 The Azimuth of the Sunne is found, out of the angle of the Sunnes position, and the difference Ascensionall.

6 In a contrary order, The Angle of the Suns Position is found by the Azimuth of the Sun, and the difference Ascensionall giuen.

The

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7 The declination of the *Sunne* is had out of the angle of the *Sunnes* position, and the eleuation of the pole giuen.

8 The *Difference Ascensionall* is found out of the *Sunnes* declination, and *Azimuth* giuen.

9 The *Eleuation of the Pole* is had out of the *Difference Ascensionall*, and the angle of the *Suns* position being giuen.

10 And lastly, The *Azimuth of the Sunne* is found by the *Eleuation of the pole*, and the *Suns* declination giuen.

And so in imitation of these foure examples, thirtie seuerall questions of Circular parts in a right-angled quadrantall, and as many in a not-right-angled quadrantall, are resolued by this generall Consequent, by the benefit of one Addition or Subtraction onely. But for the vnderstanding of the latter part of this Consequent, of the kindes of arches, see the 3. 4. 5 and 6 Examples of the Chapter following.

Of Not quadrantall mixt.

CHAP. V.



hitherto hath beene taught the doctrine of quadrantall Sphericall triangles: there followeth now the doctrine of Sphericall triangles not quadrantall.

1 A not-quadrantall is a Sphericall triangle, whereof neither side nor angle is a quadrant.

2 A not-quadrantall is reduced to two quadrantals, if from the top either a perpendicular or a

D 5

quadrant

quadrant arch be let downe to the base (extended as need shal be)

3 The perpendicular fallles within the triangle, if the angles at the base bee both of one kinde; but it fallles without if they bee of diuers kindes, and contrariwise.

4 The quadrant arch fallles without the Triangle if the legs be of one kinde; but within if they bee of diuers kindes, and contrarise.

5 Out of the sixe parts of a not quadrantall three giuen only, are sufficient to get knowledge of the rest, except of the three giuen, whereof one is opposite to the other, the third be neerer to a quadrant, then the other giuen of the same kinde: for in this case it is required also, that the kind of the part which is opposite to the third be also giuen, that the other parts may be knowne.

Examples of this case are the 4 and 6 examples following.

6 The three parts giuen are either mixt or pure.

7 They are mixt whereof one is of a diuers kinde from the other two: As when two sides and any angle are giuen, or two angles with any side.

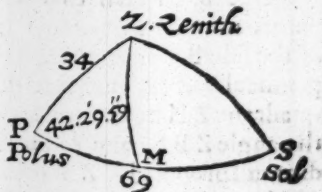
8 In mingled parts giuen, if from that tearme of the side giuen, in whose other terme is the angle giuen, a perpendicular or a quadrant arch subtending that angle, fall to the base, the not-quadrantall triangle shall be reduced to two quadrantals that may be known by the 9 Sect. of the 4 chap of this booke.

And therefore, the parts of a not. quadrantall, because they are all one with the parts, or remainders of these parts to a semicircle, are easily known, the kindes of the parts being yet first knowne by the second, third, and fourth Section of the third chapter of this booke, or else by position.

*An Example of two sides, and the angle
betweene them giuen.*

AS for vse and exercise sake, let there be a spherical triangle not quadrantal described on the superficies of the *Primum Mobile* P ZS representing the pole, the zenith, and the Sunne; whereof there be six parts.

The side P Z, which is the distance of the pole from the zenith, or the complement of the poles eleuation.



The side Z S, the distance of the zenith and Sunne, or the complement of the Sunnes height.

The side P S, the distance of the pole and the Sun, or the complement of the declination of the Sunne from the Equator.

The angle Z P S, the houre of the day, or the degrees of the Equator.

The angle P Z S, which is the Azimuth of the Sunne from the North.

The angle P S Z, which is the angle of the situation and position of the Sunne to the pole and zenith.



Of these six parts let any three be giuen,
partly

partly angles, partly sides. For example sake.

The *houre angle* Z P S 42 deg. 29' 59". which sheweth two of the clock afternoone 49' 59". and 56".

And the side P Z 34. the complement of the elevation of the Pole.

And the side P S 69 the complement of the declination of the Sunne.

Out of which that the other three partes may bee gotten : from Z the end of the side P Z that was giuen, let the perpendicular Z M, or rather (if you will) the quadrant Z H be drawne downe, subtending the angle Z P S, and reducing the not-quadrantall proposed P Z S into two triangles quadrantall in the angle M, which are P M Z, Z M S, as in the first figure : or if you bee delighted with varietie, let them be reduced to two triangles quadrantall in the side Z H, which are Z H P, and Z H S, as in the second figure. All the parts of which quadrants you shall get by the ninth Section of the 4th Chapter of this booke.

For by hauing P Z giuen ——— 34 deg.
and Z P M, or Z P S ——— 42 deg. 29' 59"
You may find the perpend. Z. M 22 deg. 11. 47
And the angle P Z M ——— 52 deg. 46. 38
And the side P M ——— 26 deg. 26. 29
Which P M being taken out } 69 deg.
of P S ——— S ———

There remaines M S. ——— 43 deg. 33. 31.

Now the side M S, and the perpendicular Z M being knowne, you may (by the said ninth Section of the fourth chapter of this booke,) finde out.

The angle opposite to the perpendicular M S Z, or that which was sought for P S Z 31. deg. 6. 17.

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And the side that was sought S Z. 47 deg.
 And the angle M Z S ————— 67 de. 38. 11
 Which being added to P Z M ————— 52 de. 46. 38

Makes P Z S the angle sought 120 de. 24. 49

You haue therefore three parts which you sought for, found by helpe of the perpendicular Z M of the former figure.

You may also finde the same by helpe of the quadrant Z H in the latter figure.

For hauing P Z giuen ————— 34 deg.

And Z P S, or Z P H ————— 42 deg. 29. 59.

You may finde by the same 9. Sect. of the 4. chap. of this booke,

The angle Z H P ————— 22 deg. 11. 47.

And the angle P Z H ————— 142 deg. 46. 38.

And the side P H ————— 116 deg. 26. 29.

Out of w^{ch} P H subtract P S 69 deg.

there remains the side S H 47 deg. 26. 29.

Which side S H being now had, together with the angle Z H P 22 deg. 11. 47. you may also (by the said 9 Section of the 4 chap. of this book) finde out

The angle H S Z ————— 148 deg. 53. 55.

And the remainder
 thereof to a semicircle, the angle P S Z } ————— 31 deg. 6. 5" that
 was sought for.

And the side S Z ————— 47 deg. that was sought for.

And lastly the angle H Z S 22 deg. 21. 49.

which being taken out } 142 deg. 46. 38.
 of H Z P. —————

There remains P Z S ————— 120 deg 24 49. the other angle that was sought for, in all poynts, as before.

An Admonition.

I^N imitation of this example, nine diuerse questions

questions may be resolved both of this, and any triangle. For by *the Eleuation of the Pole,* and *the houre of the day,* and *the declination of the Sunne that day,* being giuen, there is had, as afore:

- 1 *The Azimuth of the Sunne.*
 - 2 *The height of the Sunne.*
 - 3 *The angle of position of the Sunne :* also by ha-
uing *the declination of the Sunne,* *the angle of the*
Sunnes position, and *his height giuen,* you haue
 - 4 *The Sunnes Azimuth.*
 - 5 *The Eleuation of the Pole,*
 - 6 *The houre, or houre-arch.*
- Also if you haue *the height of the Sunne,* *his A-*
zimuth, and *the height of the pole giuen,* there
is found,
- 7 *The houre of the day.*
 - 8 *The declination of the Sunne.*
 - 9 *And the angle of the Sunnes Position.*

*The second example of two angles giuen, and
the side betweene them.*

THe angles in the figures going afore, be-
ing giuen, to wit,

The houre angle Z P S 42 deg. 19. 59.
& *the azimuth of the sun* P Z S. 120 deg. 24. 49.
with the side between }
them, being the compl. } P Z 34 deg.
of the poles eleuation

The other 3 parts are sought out. For as a-
fore,

Hauiing first giuen Z M. 22. deg. 11. 47.

And ————— P M 26 deg. 26. 29.

And the angle — P Z M. 52 deg. 46. 38.

wch being taken out of P Z S. 120 deg. 24. 49.

there being left remai. M Z S. 67 deg. 38. 11.

By

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By which M Z S, and Z M, already known,
there shall at length be found,

The side Z S — 47 deg. the side
sought for.

And the angle Z S M, or Z S P. 31 deg 6.5".
the angle sought for.

And the side M S. 42. deg. 33. 31.
which being added to P M. 26. deg. 26. 29.
the side remaineth — P S 69 deg. which was
sought for.

And these you haue by meanes of the per-
pendicular of the former figure. In like man-
ner you may finde the same by helpe of the
quadrant of the latter figure. For they are
found by the ninth Section of the fourth
chapter of this booke.

by hauing giuen the angle P H Z. 22, de. 11. 47

And the angle — P Z H. 142. de. 46. 38

Out of which the angle }
giuen P Z S being giue } 120 de. 24 49

There remaines — S Z H. 22 de. 21. 49

which together with the angle P H Z. now
knowne, all the rest of the parts are brought
forth. viz.

P Z.	34 deg.
Z P S.	42 deg. 29. 59.
P S.	69 deg.
P S Z.	31 deg. 6. 5.
S Z.	47 deg.
Z S H.	148 deg. 53. 55.
S H	47 deg. 26. 29.

An Admonition.

IN imitation of this example, nine diuerse
questions of this and of any other triangle,
are resolued.

For the *houre of the day*, the *Elevation of the*
pole,

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pole, and the suns azimuth being giuen, there is had,

- 1 The declination of the sunne,
- 2 The angle of the sunnes position.
- 3 The height of the sunne.

Also, the houre of the day, the declination of the sunne, and angle of the sunnes position being giuen, there is had,

- 4 The height of the sunne,
- 5 The sunnes azimuth,
- 6 The height of the pole.

Also, the angle of the sunnes position, the height of the sunne, & his azimuth being giuen, there is had,

- 7 The height of the pole,
- 8 The houre of the day,
- 9 The declination of the sunne.

The third example of two sides giuen, whereof that which is neereſt to a quadrant, subtendeth the angle giuen.

IN the figures afore, let there be giuen

The ſide — P Z. 34 deg.

And that which is neerer } Z S. 47 deg.
then it to a quadrant, — }

With that angle which } Z P S 42 de. 29.59
this ſide ſubtendeth — }

By the 9 Sect. of the 4. chap. of this Booke, let there be ſought out

The ſide Z M 22 deg. 11 47

And the angle P Z M 52 deg. 46 38.

And the ſide P M 26 deg. 26.29.

And in like manner you may haue

Z S M 31 deg. 6.5. or Z S P

the angle ſought for : which is moſt certainly known (by the 2 Sent. 3. chap. of this booke)

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to be lesse then a quadrant, namely, that it is 31 deg 6. 5'. ad that it is not 148 deg. 53. 5'

Also you may haue } M Z S 67 deg. 38. 11
the angle — }

which being added to P Z M 52 deg. 46. 38
makes the other angle — P Z S 120 dc. 24. 49.
which was sought for.

Lastly, you shall haue } M S 42 deg. 33. 31
the case — }

Which being added to M P 26 deg. 26. 29
makes the side — P S 69 deg. which
was sought for.

No otherwise (if you will) you may find out
the same by helpe of the quadrant Z H of the
latter figure.

*The fourth example, of two giuen sides, whereof
that which is lesse neere a quadrant subten-
deth the angle giuen, and that which is
neerest, subtendeth an angle of the
kinde giuen onely.*

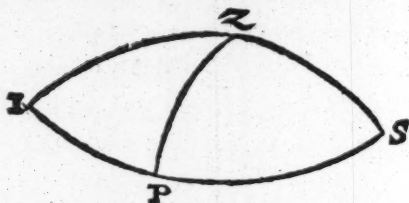
Admit there be giue } Z S 47 deg.
the sides — }

And that which is not } P Z 34 deg.
so neere a quadrant, }

with that angle which } Z S P 31 deg. 6. 5'
this subtendeth }

And let it be giue, that the angle wch ZS sub-
tendeth, that is the angle SPZ, is by kind lesse
then a quadrant: therfore the perpendicular
ZM being let down from Z to the base PS (as
before) or the quadrant ZI (as here) subten-
ding the giuen angle Z S P. By the 9 Sect. of
the 4 chap of this booke, let the other parts
be gotten (as for exercise and varieties sake)
by the quadrant of this figure, Z I, you may
get

The



The angle Z I S — 22 deg. 11. 47.

And — I Z S — 157 deg. 38. 11.

And — S I — 132 deg. 33. 31.

and in like manner } I P Z — 137 deg. 30. 1.
 you may haue }
 & by consequent } S P Z — 42 deg. 29. 59.
 the angle — }

that was sought for.

Because by the giuen position, it is expressly declared to be lesse then a quadrant: otherwise except the kinde therof were giuen, it would be vncertaine (by the 1. Sect. of the 3. chap. and the 5 sect. of this chap.) for it might otherwise haue been 137 deg. 30. 1.

So also shall you haue } I Z P. 37 deg. 13. 22
 the angle }

which being taken out of I Z S. 157 deg. 38. 11

there remains the } —————
 other angle sought. } P Z S. 120 deg. 24. 49

To conclude, you } — I P. 63 deg. 33. 31
 shall also haue }

Which being taken } — I S. 132 deg. 33. 31
 out of }

There remains ———— P S. 69 deg. the
 side that was sought for.

You shall also hit the same marks (as it were) if you seeke the account or number of the parts, by helpe of the perpendicular Z M of the first figure.

An

An Admonition.

By imitation of the third example going before, and this fourth, there are resolved eightene diuerse questions of this and any other triangle. For (as it is in the 3 example) the height of the pole, the height of the Sun, & houre of the day, being giuen, there is found,

- 1 *The Azimuth of the Sunne.*
- 2 *The angle of the Sunnes position.*
- 3 *The declination of the sunne.*

Also, the Elevation of the pole, the height of the sunne, and the angle of the sunnes position being giuen, (as in the fourth example) there are found,

- 4 *The Azimuth of the sunne,*
- 5 *The houre of the day,*
- 6 *The declination of the sunne.*

Also, the height of the sunne, the declination of the sunne, and houre of the day being giuen, there is found,

- 7 *The angle of the sunnes position,*
- 8 *The Azimuth of the sunne,*
- 9 *The Elevation of the pole.*

Also, the height of the sunne, the declination of the sunne, and Azimuth of the sunne being giuen there is found,

- 10 *The angle of the sunnes position,*
- 11 *The houre of the day,*
- 12 *The Elevation of the pole.*

Also, the declination of the sunne, the Elevation of the pole, and the angle of the sunnes position being giuen, there is found.

- 13 *The Azimuth of the sunne,*
- 14 *The height of the sunne,*
- 15 *The houre of the day.*

Also, the declination of the sun, the height of the pole, & azimuth of the sun being giuen, you haue

The

- 16 *The houre of the day,*
 17 *The angle of the sunnes position,*
 18 *The height of the sunne.*

*The fifth example of two angles giuen, the neerer
 whereof to a quadrant is subtended
 by the side giuen.*

IN the Triangle P Z S of the first Dia-
 gram,

Let the angle P S Z } ——— 31. 6. 5"
 bee giuen ———

And SPZ which is nee- } ——— 42. 29. 59.
 rer then it to a qua- }
 drant ———

With the side Z S sub- } ——— 47. 6. 6'.
 tending the same }

Out of which P S Z,
 and S Z, is found the } ——— 22. 11. 47.
 perpendicular SM ———

(By the 9th of the 4th of this booke.)

And the other parts
 of the quadrantal, } ——— M Z S. 67, 38, 11,
 S Z M, to wit, ———

And the side ——— M S. 42. 33. 31

As also by this perpendicular, with the an-
 gle Z P S being giuen, or the angle Z P M,
 all the partes of the quadrantal Z M P
 are found.

As first the side sought for P Z. For this
 is most certainly knowne (by the second
 Sentence of the first Chapter of this book)
 to be lesse then a quadrant, namely, that it
 is 34, and not 146.

Then

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Then we haue P Z M. $52, 46, 38$,
 Wch being added to S Z M. $67, 38, 11$,
 there is made the angle P Z S. $120, 24, 49$,
 Lastly, there is also had P M. $26, 26, 29$,
 Wch being added to — M S. $42, 33, 31$,
 There is made the o- } P S. $69, 0, 0$, that
 ther side, — }
 was sought for.

You may also finde out these parts other-
 wise (if you wil) by the two quadrantal of the
 figure next going before, Z I S, and Z I P.

*The sixth example of two giuen angles, whereof
 that which is not neereſt a quadrant is ſubtended
 by the ſide giuen, and that which is neereſt, is
 ſubtended by a ſide, whoſe kinde
 onely is giuen.*

OF the triangle P Z S of the firſt figure,
 let there be giuen,

The angle, Z P S, $42, 29, 59$,
 And that which is not ſo }
 neere to a quadrant as it } Z S P. $31, 6, 5$,
 With the ſide ſubten }
 ding the ſame } — P Z. $34, 0, 0$,

And let it be knowne that the ſide Z S, ſub-
 tending the angle Z P S, is leſſe then a qua-
 drant.

By theſe thus giuen, let } Z M. $22, 11, 47$
 the perpend: be ſought for. }

And the other parts of the quadrantal
 P Z M.

To wit the angle P Z M. $52, 46, 38$,

And the ſide — P M. $26, 26, 29$,

As alſo by this perpen- }
 dicular, together with } Z S M or Z S P. $31, 6, 5$,
 the angle giuen — }

Let

Let all the parts of the quadrantal ZMS be sought,

As first the desired side ZS 47. 0. 6'. because that by position giuen, it is expressly declared to bee lesse then a quadrant, otherwise it might haue been here 133. For (by the first Chap 3 and 5 of this booke) it is vncertaine, except the kinde thereof be expressly giuen,

Then the angle MZS—67. 38. 11
which added to the angle MZP—52. 46. 38

Maketh the angle PZS. 120. 24. 49
which was desired.

Lastly, there is also } ——— S M. 42, 33, 31
obtained

Which added to the side ——— P M. 26, 26, 29

Maketh the base desired ——— P S. 69, 0, 00

You may also most easily get the same parts out of the two quadrantals PHZ, and SHZ of the second figure.

An Admonition.

BY imitation of the 5 example going afore, and this sixth, 18 severall questions of this and any other Triangle are resolved.

For (as in the fifth example) out of the Angle of the position of the sunne, the houre of the day, and height of the sunne being giuen, is gotten,

- 1 The Eleuation of the pole,
- 2 The Azimuth of the sunne,
- 3 The declination of the sunne,

Also (as in this sixth example) by the houre of the day, the angle of position of the sunne, and height of the pole being giuen, there is gotten,

The

- 4 The height of the sunne,
- 5 The sunnes Azimuth,
- 6 The declination of the sunne.

Also by the houre of the day, the azimuth of the sunne, and the height of the sunne giuen, there be gotten,

- 7 The declination of the sunne,
- 8 The angle of the sunnes position,
- 9 The height of the pole.

Also by the houre of the day, the Azimuth of the sunne, and the sunnes declination giuen, you haue,

- 10 The height of the sunne,
- 11 The angle of the sunnes position,
- 12 The height of the pole.

Also by the Azimuth of the sunne, the angle of the sunnes position, and the declination of the sun giuen, there be gotten,

- 13 The height of the pole,
- 14 The houre of the day,
- 15 The height of the sunne.

Also by the azimuth of the sunne, the angle of position of the sunne, and height of the pole giuen, there be gotten,

- 16 The declination of the sunne,
- 17 The houre of the day,
- 18 The height of the sunne.

And so by the method of this Canon onely, foure and fiftie seuerall questions of the same triangle, not being quadrantall, are resolved. The rest shall be resolved hereafter.

By these therefore it is manifest, that of two angles, and their subtending sides, three being giuen the Logarithme of the fourth of them at the least, shal be made known euen without any description at all of the quadrantals. For out of the sum of the Logarithmes of the angle and side adioyning there-

to being giuen, subtract the Logarithme of the third thing that is giuen, and thence shall come the Logarithme of the fourth that was sought for; and that fourth it selfe shall also be made knowne if the kinde thereof be not unknowne.

As may be perceiued by the third, fourth, fifth, and sixth examples going before. For of the angles of the base, ZPS , and ZSP , and of their subtending leggs ZS , and ZP . let three bee giuen, (for examples sake) The leggs ZS . 47 deg. and his Logar. 312858 And — ZP . 34 deg and his Logar. 581261 with the angle adioy- } & his Logar. 392172
ning, ZPS . 42, 29, 59 }
added to the Logar. of ZP last mentioned,
Their summe is, ————— + 973433
(which is the Logarithme of the secret and suppressed perpendicular ZM , or of the angle ZHS , or ZIP .)

Out of which subtract } ——— + 312858
the Logar. of ZS — }
There remaineth the } ——— + 660575
Log. of the 4th ZSP . }
that was sought for.

Therefore the same fourth it selfe ZSP . will be 31. 6. 5". Because (by the second Section of the third chapter) it is proued to bee lesse then a quadrant.

Now contrariwise,

There being giuen ZP } ——— + 581261
34 deg. and his Logar. }
And ZS 47 deg. and his Logar. + 312858
wth the angle adioyning } & his Log. 660575
thereto ZSP , 31, 6, 5". }
added to the Logarithme of }
the side last mentioned, ZS , }
The summe is ————— + 973433
Out

Out of which take the Log. of ZP +581267

There will remaine the }
Logarithme of the 4th } ——— +392172

that was sought for: that is, ZPS, whose arch (by the 1 Sect. 3. Chap.) is vncertaine whether it be 42, 29, 59, or 137, 30, 1, except it be knowne by position giuen whether it be greater or lesse then a quadrant.

Of not-quadrantals which be pure.

CHAP. VI.



hitherto wee haue spoken of intermingled parts giuen: now follow such parts as are pure.

They are pure when the three parts giuen are of the same kinde, and they are either three sides giuen, and the angles are sought for: or the three angles giuen, and the sides are sought for.

An Admonition.

Although the pure parts are the former in regard of their simplicitie, yet for their difficultie they do worthily take the latter place.

In Sphæricall Triangles.

Halfe the base, and halfe the difference of the legs being taken together, and the Logarithme thereof, and the Logarithme of the difference of them being added together, and out of that summe, the summe of the Logarithmes of the legs being subduſted, the halfe of that which remaineth is the Logarithme of halfe the verticall angle.

Because Regiomontanus in the second chapter of his fifth booke of Triangles, and others

do teach, that *as the rectangle, comprehended under the right sines of the legs, is to the square of the whole sine: so the difference of the versed sines of the base, and difference of the legs is to the versed sine of the verticall angle.* Secing also as that difference is to this versed sine: so is the rectangle made of the right sines of the summe, and difference of the halfe base, and halfe difference of the leggs, to the square of the right sine of halfe the verticall angle (for this last rectangle is to that difference of the versed sines, and this last square to that versed sine in a 5000000^{fold} proportion, the whole sine being 10000000) therefore it shall follow, that *as the rectangle contained under the right sines of the leggs, is to the square of the whole sine, so shall the rectangle made of the right sines of the summe and difference of the halfe base and halfe difference of the leggs, be to the square of the right sine of halfe the verticall angle.* And by consequent (out of the Corolarie of the sixt Definition of the first Chapter, & the fourth Proposition of the second Chapter, and third Problem of the fift Chapter first Booke) *The summe of the Logarithmes of the leggs subtracted out of the Logarithmes of the summe and difference of the halfe base, and halfe difference of the leggs, leaueth the double of the Logarithme of halfe the verticall angle, as is aboue said.*

- 4 Secondly, halfe the base, and halfe the aggregate of the legs being taken together, and the Logarithme thereof, and the Logarithme of the difference of them being added together; & out of that summe, the summe of the Logarithmes of the leggs being subtracted, the halfe of that which remaineth is the Antilogarithme of halfe the verticall angle.

For the summe of the Logarithmes of the
summe

summe and difference of the halfe base, and halfe summe of the legs of this proposition, hath no other proportion to the summe of the Logarithmes of the summe and difference of the halfe base, and halfe difference of the legs of the former proposition, then the double of the Antilogarithme of halfe the verticall angle here, hath to the double of the Logarithme of the same halfe verticall angle before: The demonstration whereof belongeth to another place.

An Admonition.

IN Spharicall triangles also, we take the true & Alterne base in the same sence as before in right lined triangles, that is, the one for the sum, and the other for the difference of the cases. 5

Thirdly, the Differentiall of the aggregate, and the Differential of halfe the difference of the legs being added together, and out of the summe thereof the differentiall of halfe the true base being subdu- 6
cted, there will remaine the Differentiall of halfe the Alterne base.

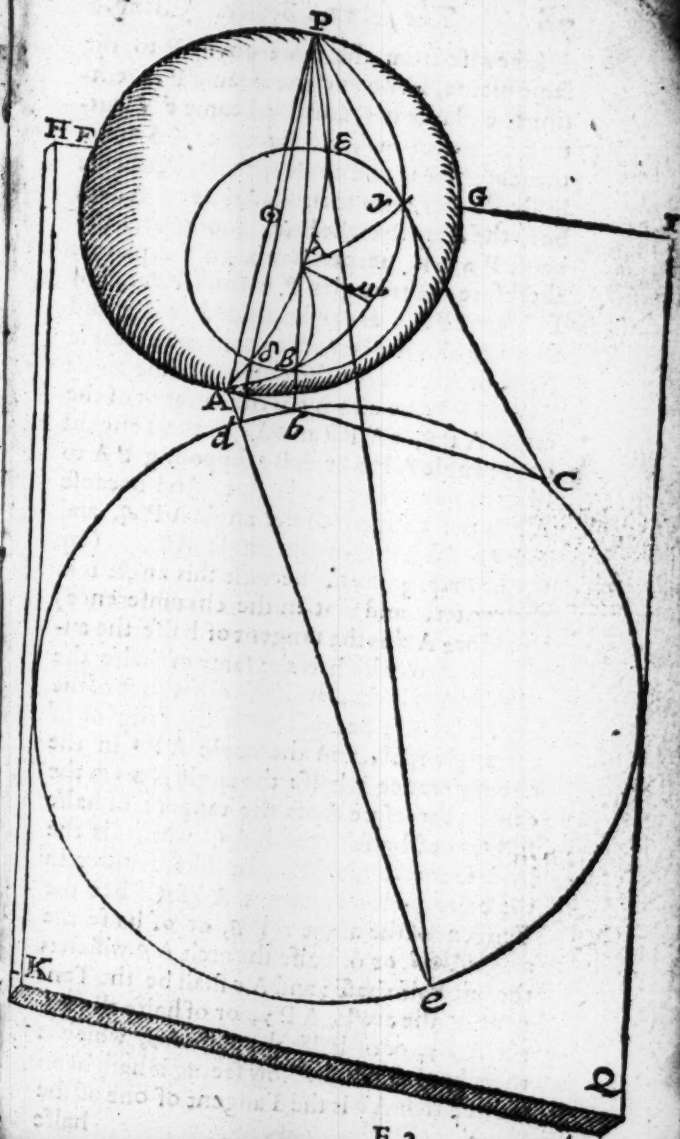
The fundamentall reason hereof is, because that as the Tangent of the true halfe base is to the Tangent of halfe the summe of the legs, so is the Tangent of halfe the difference of the legs to the Tangent of the Alterne halfe base. For the Logarithmes of Tangents are the Differentialls of their arches, by the 22 and 25 Sect. 3. Chap. 1. Booke.

And therefore shall that equalitie of the Logarithmes or Differentialls follow this analogie of the Tangents (by the 4 Prop. 2. Chap. 1. Booke.) But because the readers hereof wil perhaps require of me the demonstration

of this fundamentall analogie, or proportion of Tangents (hitherto vnknowne) I will here therefore shew the same, so farre forth as the shortnesse of this abridgement will permit.

Let the Sphære therefore A F P G lye vpon the flat superficies H I K Q, that they may touch each other in the common poynt A : from which by the center of the Sphære \odot , let the right line A \odot P be raised, cutting the vpper halfe of the Sphære in the poynt P, and so A \odot P shall bee perpendicular to the plaine or flat H I K Q. Then from the angle A, let be described vpon the superficies of the Sphære, the triangle A $\lambda \gamma$ sharpe angled in γ , or A $\lambda \beta$ blunt angled in β , and the semicircles A λ P, and A γ P, or A β P being drawne forth, taking λ for the pole, according to the distance $\lambda \gamma$, or $\lambda \beta$ which is equall thereto, draw the circle $\circ \alpha \beta \gamma$, cutting λ P in α , and λ A in α , and A $\beta \gamma$ in the poynts β and γ . From the poynt λ to the Arch A $\beta \gamma$ let downe the perpendicular Arch $\lambda \mu$. Here therefore A λ shall be the greater leg, and $\lambda \gamma$ or $\lambda \beta$ the lesse leg, A γ and A β the bases, the one true, the other alterne, A α the difference of the legs, and A \circ the summe of the legs, because $\lambda \alpha$ and $\lambda \alpha$ by the construction, are equall to the lesse leg $\lambda \gamma$ or $\lambda \beta$. This being done, and supposing P to be in stead of an eye, or some lightsome body, from the same P to the flat lying vnder H I K Q, let downe the beame P γ , cutting the flat in c , and the beame P β cutting the flat in b : and because $\gamma \beta$ A are in the same plaine or circle with the lightsome body P, their shadows $c b$ A shall be in the same right line.

Likewise



Likewise from the same poynt P to the same plaine, let downe the beame P α , cutting the plaine in e , and the beame P β cutting the plaine in d , and because $e \odot A$ are in the same plaine and circle with the lightsome body P: therefore their shadowes $e d A$ shall be in the same streight line. Moreover, because P $\odot A$ is perpendicular to the plaine, therefore the triangles P $A d$ and P $A e$, and P $A b$ and P $A c$ are right angled in A: and therefore also A d is the Tangent of the angle AP α or AP d & A e the tangent of the angle AP α or AP e . So also A b is the tangent of the angle A P β , or A P b and A c is the Tangent of the angle A P γ or A P c supposing P A to be the gnomon or whole sine. And because A d is the Tangent of the angle A P α , and A P β is the halfe of the angle A $\odot \alpha$, (by the 20 Prop. 3. Encl. because this angle is in the center, and that in the circumference) therefore A d is the tangent of halfe the angle A $\odot \alpha$, or which is the same of halfe the Arch A α , which is the halfe difference of the legs. Likewise because A e is the tangent of the angle A P α , and the angle A P α in the circumference is halfe the angle A $\odot \alpha$ in the center, therefore A e is the tangent of halfe A $\odot \alpha$, or of halfe the arch A α , which is the halfe summe of the legs. In like manner in the bases true and alterne, A b shall bee the Tangent of the angle A P β , or of halfe the angle A $\odot \beta$, or of halfe the arch A β which is the one halfe base: and A c shall be the Tangent of the angle A P γ , or of halfe the angle A $\odot \gamma$, or of halfe the arch A γ , which is the other halfe base. Now seeing it hath been shewed that A b is the Tangent of one of the halfe

halfe bases, and $A c$ the Tangent of the other halfe base, and that $A d$ is the Tangent of half the difference of the legs, and $A e$ the Tangent of halfe the summe of the legs. I say, that

As $A b$ the Tangent of the true halfe base, is to $A e$ the Tangent of the halfe summe of the legs :

So is $A d$ the tangent of the halfe difference of the legs, to $A c$ the tangent of the alterne halfe base.

Or contrariwise, by making the true base of the alterne.

As $A c$ the tangent of the true halfe base, is to $A e$ the Tangent of the halfe summe of the legs :

So is $A d$ the tangent of the halfe difference of the legs, to $A b$ the tangent of the alterne halfe-base.

Which I proue thus : If the poynts $b c d e$ be in the same circle, then as $A b$ is to $A e$, so is $A d$ to $A c$. And contrariwise, as wee said euen now (by 36 Prop. 3 and 16 Prop. 6. *Euc.*) But the poynts $b c d e$ fall in the same circle. For the shadow of any circle described in the superficies of a sphere comming from a lightsome body in the same superficies which is not in the circumference of the circle, maketh a circle perfectly round in the plaine perpendicular to the right line which goeth from the lightsome body by the center of the sphere, as it is manifest out of the Optickes, & making of the *Astrolabe* : and by *Apollonius* in his 1 book of Conick sections prop. 5. But here the circle $q b r$ is described in the superficies of the Sphere, and the lightsome body P is without the circumference of the circle, and the right line that goeth from the same by the center (that is $P \odot A$ is perpendicular to the plaine) therefore the shadow of that circle which falleth vpon the

poyns $d b c e$, is necessarily circular, and perfectly round. Therefore

As $A b$ is to $A e$, so is $A d$ to $A c$.

And contrariwise, that is,

As the tangent of the true halfe base, is to the tangent of the halfe summe of the legs :

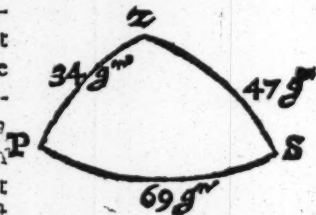
So is the tangent of the halfe difference of the legs, to the tangent of the alterne halfe base. And by consequent, the Differential of the true halfe base, subtracted out of the summe of the Differentials of the halfe summe and halfe difference of the legs, is equall to the Differential of the Alterne halfe base, which things we undertooke to demonstrate.

7 Therefore three sides of a Sphericall triangle being giuen, any one of the angles is had three wayes.

8 The first way is, That you make any side the base (especially that which commeth neereſt a quadrant) then

Adde halfe the base and halfe the difference of the legs together, and to the Logarithme thereof adde the Logarithme of the difference of them; out of which summe subduēt the summe of the Logarithme of the legs: and the halfe of the remainder is the Logarithme of an arch, which being doubled is the verticall angle. And so the rest.

As of the triangle $P Z S$, let the sides $P Z$ be giuen 34 deg. and $Z S$ 47 deg. and $S P$ 69 degr. let the angles bee sought out, and first the angle $P Z S$ coming neereſt a quadrant, which



a qua-

CHAP. 6. The second Booke. 81

a quadrant) subtendeth. Therefore let this
SP 69 be made the base : then

Adde $\frac{1}{2}$ the base, P S — 34 deg. 36

To $\frac{1}{2}$ the difference of
the legs P Z and Z S — } 6 deg. 30

The summe is 41 deg. 6. the Logar. 421504

The differ. is 28 deg. 6. the Logar. 756147

The summe is +1177651

Adde the Logar. of the

leg P Z 34 deg. 581260 } summe — +894118

To the Log. of the legg.

Z S 47 deg. +312858

Subtract the same out } the rest is 283533
of the former summe,

whereof take the halfe +141766

Whch is the Logar. of 60 deg. 12. 24. $\frac{1}{2}$
and being doubled is 120 deg. 24. 49. $\frac{1}{2}$ the ver-
ticall angle P Z S that was sought for.

No otherwise you may (if you will) finde
out the other angles : but they shall be found
more easily by 9 Chap. 5. of this booke, because
(by 2 Sent. 3 chap.) they are of a certaine and
knowne kinde.

The second way is, that any side (especially that
which is neereſt a quadrant) being made the base,
you adde halfe the base, and halfe the summe of
the legs together, and to the Logarithme thereof
adde the Logarithme of the difference of them :
out of which summe ſubduct the summe of the Lo-
garithme of the legges, and the halfe of the
remainder is the Antilogarithme of an arch, which
being doubled, is the verticall angle, and ſo the
reſt.

As of the ſame Triangle P Z S

Adde halfe the baſe P S. 34 deg. 36.

E 5

To

82 *The second Booke.* CHAP. 6

To halfe the sum of the } 40 deg. 36.
legs P Z, and Z S. —

The summe is 75 deg. 0. the Logar. 2258295

The Differ. is 6 deg. 0. the Logar. 34668

The summe is +2292963

Adde the Logar. of the

leg. P Z 34 deg. 58 1261

To the Log. of the leg

Z S. 47 deg. + 312858

} summe is +894119

Subtraet the same out

of the former summe,

} The rest is 1398844

whereof take the halfe — + 699422

Wch is the Antilog. of 60 deg. 12.24.1/2

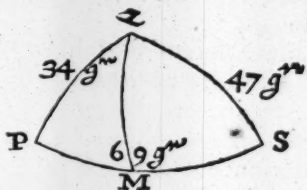
and being doubled is 120 deg. 24.49. the ver-
ticall angle P Z S sought for.

The other angles, although you may finde
after this manner, yet you shall finde them
more easly by 9 Chap 5. of this booke. For by
the second sentence of the third Chap. they
are of a knowne kinde.

10 *The third way is, that any side being put for the
base, you adde the Differential of halfe the summe
of the legs, to the Differentiall of halfe the diffe-
rence of the legs, and subtraet from the product
the Differentiall of the true halfe base, and there
shall come thereof the Differential of the alterne
halfe base. The summe of which halfe bases is the
greater case, and the difference the lesse case, di-
stinguishing two right-angled triangles, which do
make knowne both their owne parts, and all the
parts of the triangle proposed (by 9 chap. 4. and 8
chap. 5. of this booke.)*

As the sides of the triangle propounded
P Z S being given, as before, let the angles at
the base Z P S, and Z S P be sought for.

halfe



Half the sum
of the leggs } 40 deg. 30. the Differ. 157730
P Z, & Z S is

Half the dif-
ference of } 6 deg. 30. the Differ 2172127
them is —

Wch added together, bring forth 2329851

From which subtract
the differ: of halfe } viz. 34. deg. 30. 375012
the true base P Z.

And there will remaine + 1954839

Which is the Differential of 8 deg. 3. 31. halfe
the alterne base.

Adde therefore together the two halfe ba-
ses, to wit,

Halfe the true base 34 deg. 30. 0.
and halfe the altern base 8 deg. 3. 31.

And they make — 42 deg. 33. 31. the
greater case M S.

Take the one out } rests 26 deg. 26. 29. the
of the other, }
lesse case P M.

Therefore by helpe of these cases, you
haue now two triangles right angled at M,
that is P M Z, and S M Z, which do lay open
both the perpendicular Z M, and the verti-
call angles P Z M and S Z M: or (if you will)
P Z S (by 9 Chap. 4 and 8 Chap. 5 of this book)
But these things being omitted, let vs return
to

84 *The second Booke.* CHAP. 6

to the angles of the base ZPS , ZSP which were sought for.

Add the Differential of the
case $P M$. 26, 26, 29 already } — + 698552
found (by 9 Sect. 4 Chap.)

To the Differential of the
complement of PZ , which is } — 393771
56 degrees ————

There will come forth — + 304781

Which is the Logarithme of the complement of the angle ZPS , which complement is 47 deg, 30, 1.

Likewise,

Add the Differential of the
greater case SM 42 de. 33, 31 } — + 85324
already found by the 9 Sect.

To the Differential of the
complement of SZ , which is } — + 69870
43 degrees ————

There will come forth — + 155194

Which is the Logarithme of the complement of the angle ZSP , which complement is 58 deg. 53, 55.

But here remember, that not the parts PZ 34, and ZPS , or SZ 47, and ZSP , but their complements, that is, 56 degr. and 47, 30, 1. and 43 deg. and 58 53, 55. are here called circular parts, (by 2 Chap. 4. of this booke) Therefore the true angle sought for ZPS , is 42, 29, 59.

And ZSP is 31, 6, 5.

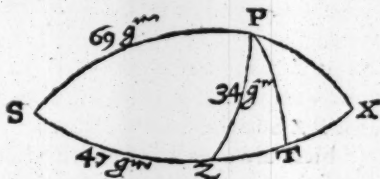
As it also manifest by 8 Sect. Chap 5. of this booke.

Another example of the same triangle.

THe same triangle PZS being placed otherwise,

CHAP. 6. The second Booke. 85

therwise, let ZS be the base, and the sides being giuen, as before, let the angle P Z S. bee sought for. Therefore



Halfe the sum
of the legs S P } 51 deg. 30 the Differ. 228865
and P Z is — }
Half the difference of them } 17 de. 30. the Diff. + 1154234
is — }

Which added together, } — + 925369
bring forth the Differ. }
From wch subtract the
Differentiall of halfe } 23 de. 30 + 832840
the true base S Z, viz. of }

And there will remaine — + 92529
Wch is the Differential of 42 deg. 21. 11. halfe
the alterne base.

Adde therefore together the two halfe bases, to wit,

Halfe the true base 23 deg. 30, 0.
And half the alterne base 42 deg. 21, 11,
And there wil come forth 65 deg. 51, 11, the
greater case S T.

Take the difference of them 18 deg. 51, 11, the
lesse case T X. or T Z.

Adde therefore the Differentiall of the same T Z, } — + 1074520
18, 51, 11, viz. — }

To

To the differentiaall of the
 complement of Z P, which } ————— 393771
 is 56 degrees —————

And from thence will arise ————— + 680749
 Which is the Logarithme of the complement
 of the angle P Z T. 59 deg. 35.11

Of which angle P Z T, seeing the angle
 sought for P Z S is the remainder to a semi-
 circle (which alwayes happeneth when the
 alterne base is greater then the true) the an-
 gle P Z S must needs be 120 degrees, 24, 49,
 otherwise if the true base exceed the alterne
 base, the angles P Z T, and P Z S shall bee
 all one.

An Admonition.

YOU haue now three true wayes to finde
 out the angles by the sides giuen, by eue-
 ry one whereof three seuerall questions of
 this and any other triangle are resolued.

For by the elevation of the pole, the height of
 the Sunne, and declination of the sunne being
 giuen, they that doubt are satisfied concer-
 ning the question: whereby either

- 1 The Azimuth of the Sunne,
- 2 The angle of the situation and position
 of the Sunne: or.

- 3 The houre of the day is demanded.

*Hitherto wee haue found the angles by the
 sides.*

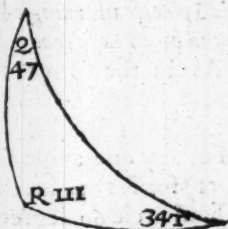
*It remaineth to finde the sides by the an-
 gles.*

- II *In any Sphericall Triangle the sides may bee
 changed into angles, and the angles into sides: yet
 taking first for any one angle and his subtending
 side, the remainders of them to a semicircle.*

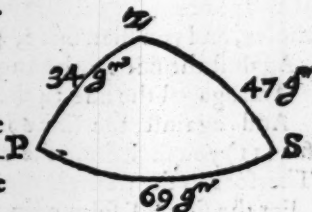
For example sake.

Let QRT be a triangle, whose angles let bee Q 47, R 111, and T 34.

Let vs first take for any angle, as for R 111, his remainder to a semicircle, which is 69 degrees.



I say that these angles 47^d. 69^d. 34^d. may bee changed into sides, & the triangle PZS going afore, and heere now againe expressed shall be made.



Wherein PZ is 34 degrees,

ZS is 47 degrees,

And PS is 69 degrees,

As also of the angles of this repeated triangle shall mutually bee made the sides of the other:

For the angle of this triangle ZSP 31, 6, 5. is the side of the other triangle QR .

And the angle of this ZPS 42, 29, 59. is the side of the other RT .

And of the third angle of this triangle which is SZP 120, 24, 49. the remainder to a semicircle that is 59, 35, 11. is the side QT of the other triangle.

The demonstration whereof *Bartholomew Pitiscus*, *Adrian Metius* and others set downe, therefore I thinke it no need to repeate the same

same in this short Treatise.

72 From whence it followeth, that the three angles of a Sphericall triangle being giuen, the sides are found by an easie conuersion.

As in the former triangle QRT , let the angles be giuen Q 47, R 111, and T 34, let the sides be sought.

For any one angle, for example sake, (as before) for R 111, let the remainder thereof to a semicircle 69 degrees be taken.

Then 47, 69, 34 being set for sides (as was done in the former triangle PZS , by any of the three wayes aboue written, seeke his angles, and you shall finde,

Against the side 47, the angle 42.29.59.

And against the side 34 the angle 31.6.5.

And against the side 69 (which wee put for 111) you shall finde the angle 120.24.49. Therefore in the triangle propounded, QRT .

For the side RT subtending the angle Q 47, set downe 42.29.59.

And for the side QR subtending the angle T 34, set downe 31.6.5.

But for the side QT subtending the angle R 111. set downe 59.35.11.

Which are the remainder of 120 deg. 24.49. to a semicircle, because before you tooke for 111 his remainder to a semicircle, that is 69. And so by conuersion you shal finde the sides by the angles.

An Admonition.

OVt of this finding of the sides by the angles giuen, three diuers questions of this and any other triangle whatsoeuer are resolved.

As in the triangle PZS out of the *houre of the day*, the *azimuth of the Sunne*, and the *angle of*

CHAP. 6. *The second Booke.* 89

of the site or position of the Sunne, this proposition going before, giueth satisfaction to the question, whereby either

- 1 The height of the pole,
- 2 The height of the Sunne, or
- 3 The declination of the Sunne is demanded.

Therefore (out of the 8 sect. of the former 5 chap. and the 7 & 12 sect. of this booke) you haue the solution of 60 seuerall questions, wch fall into any triangle: neither can there any more varieties then these arise out of the manifold composition of any three parts.

You haue therefore a perfect & absolute doctrine of triangles, as well Sphericall as Plaine.

THE CONCLUSION.

Now therefore it hath been sufficiently shewed that there are Logarithmes, what they are, and of what use they are: for with helpe. of them we haue both demonstratiuely shewed and taught by examples of both kindes of Trigonometrie, that the Arithmetickall solution of any Geometricall question may most readily bee performed without trouble of Multiplication, Diuision, or extraction of roots. You haue therefore the admirable Table of Logarithmes that was promised, together with the most plentifull use thereof, which if (to you of the learned sort) I shall by your letters understand to be acceptable to you, I shall be incouraged to set forth also the way to make the Table. In the meane time, make use of this short Treatise, and giue all praise and glory to God the high Inuenter and guider of all good workes.

The end of the Treatise.

Now followeth the Table or Canon of
Logarithmes.

Deg. 0

+1-

mi	Sines	Logarith.	Differen.	Logarith.	Sines
0	0	Infinite.	Infinite.	.0	1000000.0
1	291	8142567	8142568	.1	1000000.0
2	582	7449419	7449421	.2	999999.8
3	873	7043952	7043956	.4	999999.6
4	1164	6756275	6756274	.7	999999.3
5	1454	6533131	6533130	1.1	999998.9
6	1745	6350810	6350808	1.6	999998.6
7	2036	6196659	6196657	2.2	999998.0
8	2327	6063128	6063126	2.8	999997.4
9	2618	5945345	5945342	3.5	999996.7
10	2909	5839986	5839984	4.3	999995.9
11	3200	5744676	5744671	5.2	999995.0
12	3491	5657665	5657658	6.2	999994.0
13	3781	5577622	5577615	7.3	999992.8
14	4072	5503514	5503506	8.4	999991.7
15	4363	5434522	5434513	9.6	999990.5
16	4654	5369984	5369973	10.9	999989.2
17	4945	5309360	5309348	12.3	999987.8
18	5236	5252202	5252188	13.8	999986.3
19	5527	5198136	5198120	15.4	999984.7
20	5818	5146843	5146836	17.0	999983.1
21	6109	5098054	5098045	18.7	999981.3
22	6399	5051534	5051514	20.5	999979.5
23	6690	5007083	5007060	22.4	999977.6
24	6981	4964524	4964499	24.4	999975.6
25	7272	4923703	4923676	26.5	999973.6
26	7563	4884483	4884454	28.7	999971.4
27	7854	4846743	4846712	30.9	999969.2
28	8145	4810376	4810343	33.2	999966.8
29	8436	4775286	4775250	35.6	999964.4
30	8726	4741385	4741347	38.1	999961.9

Min

Deg. 89

Deg. 2 + | -

m.	Sines	Logarith.	Differen.	Logarit.	Sines	
30	43619	3132252	3131300	952	999048	30
31	43910	3135612	3124647	965	999035	29
32	44201	3119016	3118038	978	999023	28
33	44491	3112463	3111472	991	999010	27
34	44782	3105952	3104948	1004	998997	26
35	45072	3099484	3098467	1017	998984	25
36	45363	3093058	3092028	1030	998971	24
37	45654	3086672	3085629	1043	998957	23
38	45944	3080328	3079271	1056	998944	22
39	46235	3074023	3072953	1070	998931	21
40	46525	3067758	3066674	1083	998917	20
41	46816	3061522	3060435	1097	998904	19
42	47106	3055344	3054233	1111	998890	18
43	47397	3049195	3048070	1124	998876	17
44	47688	3043083	3041945	1138	998862	16
45	47978	3037009	3035857	1152	998848	15
46	48269	3030971	3029805	1166	998834	14
47	48559	3024970	3023790	1180	998820	13
48	48850	3019005	3017810	1194	998806	12
49	49140	3013075	3011866	1209	998792	11
50	49431	3007180	3005950	1223	998777	10
51	49721	3001319	3000082	1238	998763	9
52	50012	2995493	2994241	1252	998749	8
53	50302	2989701	2988435	1267	998734	7
54	50593	2983942	2982661	1281	998719	6
55	50883	2978216	2976920	1296	998704	5
56	51174	2972524	2971212	1311	998690	4
57	51464	2966863	2965537	1326	998675	3
58	51755	2961233	2959892	1341	998660	2
59	52045	2955636	2954280	1356	998645	1
60	52336	2950071	2948699	1372	998629	0

Min.

Deg. 87

Deg. 3

11

m.	Sines	Logarith.	Differen.	Logarit.	Sines
0	52336	2950071	2948699	1371	99862960
1	52626	2944535	2943149	1387	99861459
2	52917	2939030	2937629	1402	99859958
3	53207	2933556	2932139	1418	99858357
4	53498	2928112	2926671	1433	99856856
5	53788	2922697	2921249	1449	99855255
6	54079	2917311	2915847	1464	99853754
7	54369	2911954	2910475	1480	99852153
8	54660	2906627	2905131	1496	99850552
9	54950	2901327	2899815	1512	99848951
10	55241	2896056	2894528	1528	99847350
11	55531	2890812	2889267	1544	99845749
12	55822	2885595	2884035	1560	99844148
13	56112	2880406	2878829	1577	99842447
14	56402	2875243	2873650	1593	99840849
15	56693	2870107	2868497	1610	99839245
16	56983	2864997	2863371	1626	99837544
17	57274	2859914	2858271	1643	99835943
18	57564	2854857	2853198	1659	99834242
19	57854	2849825	2848148	1676	99832541
20	58145	2844818	2843125	1693	99830840
21	58435	2839835	2838125	1710	99829139
22	58726	2834878	2833151	1727	99827438
23	59016	2829946	2828201	1744	99825737
24	59306	2825038	2823276	1762	99824036
25	59597	2820153	2818375	1779	99822235
26	59887	2815293	2813497	1796	99820534
27	60177	2810456	2808642	1814	69818833
28	60468	2805643	2803811	1831	99817032
29	60758	2800852	2799003	1849	99815231
30	61048	2796085	2794218	1867	99813530

1111

Deg. 86

Deg. 3 + -

m.	Sines.	Logarith	Differen.	Logarit.	Sines.	
60	30	61048	2796085	2794218	1867	998135 30
59	31	61339	2791340	2789455	1885	998117 29
58	32	61629	2786618	2784715	1903	998099 28
57	33	61920	2781918	2779998	1921	998081 27
56	34	62210	2777241	2775302	1939	998063 26
55	35	62500	2772585	2770628	1957	998045 25
54	36	62790	2767950	2765975	1975	998027 24
53	37	63081	2763337	2761344	1993	998008 23
52	38	63371	2758746	2756734	2012	997990 22
51	39	63661	2754175	2752145	2030	997972 21
50	40	63952	2749626	2747577	2049	997953 20
49	41	64242	2745097	2743029	2068	997934 19
48	42	64532	2740588	2738502	2086	997916 18
47	43	64823	2736100	2733995	2105	997897 17
46	44	65113	2731632	2729508	2124	997878 16
45	45	65403	2727184	2725041	2143	997859 15
44	46	65693	2722756	2720594	2162	997840 14
43	47	65984	2718348	2716166	2181	997821 13
42	48	66274	2713958	2711757	2201	997801 12
41	49	66564	2709588	2707368	2220	997782 11
40	50	66854	2705237	2702998	2240	997763 10
39	51	67145	2700906	2698646	2259	997743 9
38	52	67435	2696592	2694314	2279	997724 8
37	53	67725	2692298	2689999	2298	997704 7
36	54	68015	2688022	2685703	2318	997684 6
35	55	68305	2683764	2681426	2338	997664 5
34	56	68596	2679524	2677166	2358	997645 4
33	57	68886	2675303	2672924	2378	997625 3
32	58	69176	2671098	2668700	2398	997604 2
31	59	69466	2666913	2664494	2419	997584 1
30	60	69756	2662744	2660305	2439	997564 0

Min

F

Deg. 86

Deg. 4 + | -

m.	Sines	Logarith.	Differen.	Logarit.	Sines
0	69756	2662744	2660305	2439	99756460
1	70047	2658593	2656133	2459	99754459
2	70337	2654459	2651979	2480	99752358
3	70627	2650342	2647841	2500	99750357
4	70917	2646242	2643721	2521	99748256
5	71207	2642159	2639617	2542	99746155
6	71497	2638093	2635530	2563	99744154
7	71788	2634043	2631459	2583	99742053
8	72078	2630009	2627405	2604	99739952
9	72368	2625992	2623367	2625	99737851
10	72658	2621991	2619345	2646	99735750
11	72948	2618007	2615339	2668	99733649
12	73238	2614038	2611349	2689	99731548
13	73528	2610084	2607373	2710	99729447
14	73818	2606146	2603415	2732	99727246
15	74108	2602224	2599471	2753	99725045
16	74398	2598318	2595542	2775	99722944
17	74689	2594426	2591629	2797	99720743
18	74979	2590550	2587731	2819	99718542
19	75269	2586688	2583848	2841	99716341
20	75559	2582842	2579980	2863	99714140
21	75849	2579011	2575126	2885	99711939
22	76139	2575194	2571287	2907	99709738
23	76429	2571392	2567473	2929	99707537
24	76718	2567604	2563653	2952	99705336
25	77009	2563831	2560857	2974	99703035
26	77299	2560072	2557076	2996	99700834
27	77589	2556327	2553308	3019	99698533
28	77879	2552597	2549555	3042	99696332
29	78169	2548880	2545815	3065	99694031
30	78459	2545177	2542089	3087	99691729

Min.

Deg. 85

Deg. 4 + -

m.	Sines	Logarith.	Differen.	Logarith.	Sines	
30	78459	2545177	2542089	3087	996917	30
31	78749	2541488	2538377	3110	996894	29
32	79039	2537812	2534678	3133	996871	28
33	79329	2534150	2530993	3156	996848	27
34	79619	2530501	2527322	3180	996825	26
35	79909	2526866	2523663	3203	996802	25
36	80199	2523244	2520018	3226	996779	24
37	80489	2519635	2516386	3250	996755	23
38	80779	2516040	2512767	3273	996732	22
39	81069	2512457	2509160	3297	996708	21
40	81359	2508887	2505566	3321	996685	20
41	81649	2505330	2501985	3344	996661	19
42	81938	2501785	2498417	3368	996637	18
43	82228	2498253	2494861	3392	996613	17
44	82518	2494754	2491318	3416	996589	16
45	82808	2491227	2487787	3440	996565	15
46	83098	2487733	2484268	3465	996541	14
47	83388	2484250	2480761	3489	996517	13
48	83678	2480780	2477267	3513	996493	12
49	83968	2477322	2473784	3537	996468	11
50	84257	2473866	2470314	3562	996444	10
51	84547	2470442	2466855	3587	996419	9
52	84837	2467020	2463408	3612	996395	8
53	85127	2463609	2459973	3636	996370	7
54	85417	2460210	2456549	3661	996345	6
55	85707	2456823	2453136	3686	996320	5
56	85996	2453447	2449736	3711	996295	4
57	86286	2450083	2446346	3737	996270	3
58	86576	2446730	2442968	3762	996245	2
59	86866	2443388	2439601	3787	996220	1
60	87156	2440058	2436245	3813	996195	0

Min.

Deg. 5 + —

m	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	87156	2440058	2436245	3813	99619560
1	87445	2436738	2432900	3838	99616959
2	87735	2433430	2429566	3864	99614458
3	88025	2430133	2426243	3889	99611857
4	88315	2426847	2422932	3915	99609356
5	88604	2423571	2419630	3941	99606755
6	88894	2420306	2416340	3967	99604154
7	89184	2417052	2413059	3993	99601553
8	89474	2413809	2409790	4019	99598952
9	89763	2410576	2406531	4045	99596351
10	90053	2407354	2403282	4071	99593750
11	90343	2404142	2400045	4098	99591049
12	90632	2400941	2396817	4124	99588448
13	90922	2397749	2393599	4150	99585847
14	91212	2394568	2390391	4177	99583146
15	91502	2391398	2387194	4204	99580545
16	91791	2388237	2384007	4230	99577844
17	92081	2385087	2380829	4257	99575143
18	92371	2381946	2377661	4284	99572442
19	92660	2378815	2374504	4311	99569841
20	92950	2375694	2371356	4339	99567040
21	93239	2372583	2368217	4365	99564439
22	93529	2369482	2365089	4393	99561638
23	93819	2366390	2361967	4420	99558937
24	94108	2363308	2358860	4448	99556236
25	94398	2360235	2355760	4475	99553535
26	94687	2357172	2352669	4503	99550734
27	94977	2354119	2349588	4531	99547933
28	95267	2351075	2346516	4558	99545232
29	95556	2348040	2343453	4586	99542431
30	95846	2345014	2340400	4614	99539630

Min.

Deg. 84

Deg. 5

+-

m	Sines	Logarith.	Differen.	Logarit.	Sines	
30	95846	2345014	2340400	4614	995396	30
31	96135	2341998	2337356	4642	995368	29
32	96425	2338991	2334320	4670	995340	28
33	96714	2335993	2331294	4699	995312	27
34	97004	2333004	2328277	4727	995284	26
35	97293	2330023	2325268	4755	995256	25
36	97583	2327052	2322269	4784	995227	24
37	97872	2324090	2319278	4812	995199	23
38	98161	2321137	2316296	4841	995170	22
39	98451	2318192	2313322	4870	995142	21
40	98741	2315256	2310357	4899	995113	20
41	99030	2312229	2307401	4928	995084	19
42	99320	2309410	2304453	4957	995056	18
43	99609	2306500	2301514	4986	995027	17
44	99899	2303598	2298584	5015	994998	16
45	100188	2300706	2295661	5044	994968	15
46	100477	2297821	2292748	5073	994939	14
47	100767	2294945	2289842	5103	994910	13
48	101056	2292077	2286945	5132	994881	12
49	101346	2289217	2284055	5162	994851	11
50	101635	2286366	2281174	5192	994822	10
51	101924	2283523	2278301	5221	994792	9
52	102214	2280688	2275437	5251	994762	8
53	102503	2277861	2272580	5281	994733	7
54	102793	2275042	2269731	5311	994703	6
55	103082	2272231	2266890	5341	994673	5
56	103371	3269428	2264057	5371	994643	4
57	103661	2266633	2261232	5402	994613	3
58	103950	2263846	2258414	5432	994583	2
59	104239	2261066	2255604	5463	994552	1
60	104528	2258295	2252802	5493	994522	0

Min.

F 3

Deg. 84

Deg. 6

+1-

m.	Sines	Logarith.	Differen.	Logarit.	Sines
0	104528	2258295	2252802	5493	99452260
1	104818	2255531	2250007	5524	99449159
2	105107	2252775	2247221	5554	99446158
3	105396	2250027	2244441	5585	99443057
4	105686	2247286	2241670	5616	99440056
5	105975	2244553	2238905	5647	99436955
6	106264	2241827	2236149	5678	99433854
7	106553	2239109	2233400	5709	99430743
8	106843	2236398	2230658	5740	99427652
9	107132	2233695	2227923	5772	99424551
10	107421	2230999	2225196	5803	99421450
11	107710	2228310	2222476	5835	99418249
12	107999	2225629	2219763	5866	99415148
13	108289	2222954	2217057	5898	99411947
14	108578	2220288	2214358	5930	99408846
15	108867	2217628	2211667	5961	99405645
16	109156	2214976	2208983	5993	99402544
17	109445	2212331	2206305	6025	99399343
18	109734	2209692	2203635	6057	99396142
19	110023	2207061	2200972	6089	99392941
20	110313	2204437	2198315	6122	99389740
21	110602	2201819	2195665	6154	99386539
22	110891	2199209	2193023	6186	99383338
23	111180	2196605	2190386	6219	99380037
24	111469	2194009	2187757	6251	99376836
25	111758	2191419	2185134	6284	99373535
26	112047	2188835	2182518	6317	99370334
27	112336	2186259	2179909	6350	99367033
28	112625	2183689	2177306	6383	99363832
29	112914	2181126	2174710	6416	99360531
30	113203	2178570	2172121	6449	99357230

Min.

Deg. 83

Deg. 6

+ | -

m.	Sines	Logarith.	Differen.	Logarit.	Sines
30	113203	2178570	2172121	6449	993572 30
31	113492	2176020	2169538	6482	993539 29
32	113781	2173477	2166961	6515	993506 28
33	114070	2170940	2164392	6549	993473 27
34	114359	2168410	2161828	6582	993439 26
35	114648	2165886	2159270	6616	993406 25
36	114937	2163369	2156720	6649	993373 24
37	115226	2160859	2154176	6683	993339 23
38	115515	2158354	2151637	6717	993305 22
39	115804	2155856	2149105	6751	993272 21
40	116093	2153364	2146579	6785	993238 20
41	116382	2150878	2144059	6819	993205 19
42	116671	2148399	2141546	6853	993171 18
43	116960	2145925	2139038	6887	993137 17
44	117248	2143458	2136537	6921	993103 16
45	117537	2140998	2134042	6956	993068 15
46	117826	2138543	2131553	6990	993034 14
47	118115	2136095	2129070	7025	993000 13
48	118404	2133652	2126593	7059	992966 12
49	118693	2131216	2124122	7094	992931 11
50	118982	2128785	2121657	7129	992896 10
51	119270	2126361	2119197	7164	992862 9
52	119559	2123942	2116744	7199	992827 8
53	119848	2121530	2114296	7234	992792 7
54	120137	2119123	2111854	7269	992757 6
55	120425	2116722	2109418	7304	992722 5
56	120714	2114327	2106988	7340	992687 4
57	121003	2111938	2104563	7375	992652 3
58	121292	2109555	2102144	7410	992617 2
59	121580	2107177	2099731	7446	992582 1
60	121869	2104805	2097323	7482	992546 0

Min.

Deg. 7

+1—

m	Sines	Logarith.	Differen.	Logarit.	Sines
0	121869	2104805	2097823	7482	99254660
1	122158	2102438	2094921	7518	99251159
2	122447	2100078	2092524	7555	99247558
3	122735	2097723	2090134	7589	99243957
4	123024	2095374	2087748	7625	99240456
5	123313	2093030	2085369	7661	99236855
6	123601	2090692	2082995	7698	99233254
7	123890	2088359	2080626	7734	99229643
8	124179	2086032	2078262	7770	99226052
9	124467	2083711	2075904	7807	99222451
10	124756	2081394	2073551	7843	99218750
11	125044	2079084	2071204	7880	99215149
12	125333	2076778	2068862	7917	99211548
13	125622	2074478	2066525	7953	99207847
14	125910	2072184	2064193	7990	99204246
15	126199	2069895	2061867	8027	99200545
16	126488	2067611	2059546	8064	99196844
17	126776	2065332	2057231	8101	99193143
18	127065	2063059	2054920	8138	99189442
19	127353	2060791	2052615	8176	99185741
20	127642	2058528	2050315	8213	99182040
21	127930	2056270	2048019	8251	99178339
22	128219	2054018	2045729	8288	99174638
23	128507	2051770	2043444	8326	99170937
24	128796	2049528	2041164	8364	99167136
25	129084	2047291	2038889	8401	99163435
26	129373	2045059	2036619	8439	99159634
27	129661	2042832	2034354	8477	99155833
28	129949	2040610	2032094	8515	99152132
29	130238	2038392	2029839	8554	99148331
30	130526	2036180	2027589	8592	99144530

Min.

Deg. 82

Deg. 7

+|-

mi	Sines	Logarit ^h	Differen	Logarit ^h	Sines	
30	130526	2036180	2027589	8592	991445	30
31	130815	2033974	2025343	8630	991407	29
32	131103	2031772	2023100	8669	991369	28
33	131391	2029575	2020867	8707	991331	27
34	131680	2027382	2018636	8746	991292	26
35	131968	2025195	2016410	8784	991254	25
36	132256	2023012	2014189	8823	991216	24
37	132545	2020834	2011972	8862	991177	23
38	132833	2018661	2009760	8901	991138	22
39	133121	2016493	2007553	8940	991100	21
40	133410	2014330	2005351	8979	991061	20
41	133698	2012172	2003153	9018	991022	19
42	133986	2010018	2000960	9058	990983	18
43	134274	2007869	1998772	9097	990944	17
44	134563	2005724	1996588	9136	990905	16
45	134851	2003585	1994409	9176	990866	15
46	135139	2001449	1992234	9216	990827	14
47	135427	1999319	1990063	9255	990787	13
48	135716	1997193	1987898	9295	990748	12
49	136004	1995072	1985737	9335	990708	11
50	136292	1992955	1983580	9375	990669	10
51	136580	1990843	1981428	9415	990629	9
52	136868	1988736	1979280	9455	990589	8
53	137156	1986633	1977137	9495	990549	7
54	137445	1984534	1974998	9536	990509	6
55	137733	1982440	1972864	9576	990469	5
56	138021	1980350	1970734	9617	990429	4
57	138309	1978265	1968608	9657	990389	3
58	138597	1976184	1966486	9698	990349	2
59	128885	1974108	1964369	9739	990308	1
60	139173	1972036	1962257	9780	990268	0

Min

F 5

Deg. 82

Deg. 8

+—

m	Sines	Logarith.	Differen	Logarit.	Sines
0	139173	1972036	1962257	9780	99026860
1	139461	1969969	1960148	9820	99022859
2	139749	1967905	1958044	9861	99018758
3	140037	1965846	1955944	9903	99014657
4	140325	1963792	1953848	9944	99010556
5	140613	1961741	1951756	9985	99006555
6	140901	1959695	1949669	10026	99002454
7	141189	1957653	1947586	10068	98998353
8	141477	1955616	1945507	10109	98994252
9	141765	1953583	1943432	10151	98990051
10	142053	1951554	1941361	10193	98985950
11	142341	1949530	1939294	10234	98981849
12	142629	1947508	1937232	10276	98977648
13	142916	1945492	1935173	10318	98973547
14	143205	1943479	1933119	10360	98969349
15	143493	1941471	1931069	10402	98965145
16	143780	1939467	1929022	10445	98961044
17	144068	1937467	1926980	10487	98956843
18	144356	1935471	1924941	10529	98952642
19	144644	1933479	1922907	10572	98948441
20	144932	1931491	1920876	10614	98944240
21	145220	1929507	1918850	10657	98939939
22	145507	1927527	1916828	10700	98935738
23	145795	1925552	1914809	10743	98931537
24	146083	1923580	1912794	10785	98927236
25	146371	1921612	1910783	10828	98923035
26	146659	1919648	1908776	10872	98918734
27	146946	1917687	1906773	10915	98914433
28	147234	1915731	1904773	10958	98910232
29	147522	1913779	1902778	11001	98905931
30	147809	911831	1900786	11045	98901630

Min.

Deg. 81

Deg. 8

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mi	Sines	Logarith	Differen	Logarit.	Sines.	
30	147809	1911831	1900786	11045	988015	30
31	148097	1909886	1898798	11088	988973	29
32	148385	1907946	1896814	11132	988930	28
33	148672	1906009	1894833	11176	988887	27
34	148960	1904076	1892857	11219	988843	26
35	149248	1902147	1890883	11263	988800	25
36	149535	1900221	1888914	11307	988756	24
37	149822	1898300	1886948	11351	988713	23
38	150110	1896382	1884987	11395	988669	22
39	150398	1894468	1883028	11440	988625	21
40	150686	1892553	1881074	11484	988582	20
41	150973	1890652	1879123	11528	988538	19
42	151261	1888749	1877176	11573	988494	18
43	151548	1886850	1875232	11617	988450	17
44	151836	1884954	1873292	11662	988406	16
45	152123	1883062	1871356	11707	988361	15
46	152411	1881174	1869423	11752	988317	14
47	152698	1879290	1867493	11797	988273	13
48	152986	1877409	1865567	11842	988228	12
49	153273	1875532	1863645	11887	988184	11
50	153561	1873658	1861726	11932	988139	10
51	153848	1871788	1859811	11977	988094	9
52	154136	1869922	1857899	12022	988050	8
53	154423	1868059	1855991	12068	988005	7
54	154710	1866199	1854086	12113	987960	6
55	154998	1864344	1852185	12159	987915	5
56	155285	1862491	1850287	12204	987870	4
57	155572	1860643	1848392	12250	987824	3
58	155860	1858797	1846501	12296	987779	2
59	156147	1856956	1844614	12342	987734	1
60	156434	1855117	1842729	12388	987688	0

Min.

Deg. 81

Deg. 9



W.	Sines	Logarith	Differen.	Logarit.	Sines
0	156434	1855117	1842729	12388	98768860
1	156721	1853283	1840848	12434	98764359
2	157009	1851451	1838971	12480	98759758
3	157296	1849623	1837096	12527	98755157
4	157584	1847798	1835225	12573	98750656
5	157870	1845977	1833358	12620	98746055
6	158158	1844152	1831493	12666	98741454
7	158445	1842345	1829632	12713	98736853
8	158731	1840534	1827775	12759	98732252
9	159020	1838726	1825920	12806	98727651
10	159307	1836922	1824069	12853	98723050
11	159594	1835121	1822221	12900	98718449
12	159881	1833324	1820376	12947	98713848
13	160168	1831526	1818535	12994	98709247
14	160455	1829738	1816697	13041	98704646
15	160743	1827951	1814862	13089	98699745
16	161030	1826166	1813030	13136	98695044
17	161317	1824385	1811201	13184	98690343
18	161604	1822607	1809376	13231	98685642
19	161891	1820832	1807553	13279	98680941
20	162178	1819061	1805734	13327	98676240
21	162465	1817292	1803918	13375	98671439
22	162752	1815527	1802104	13423	98666738
23	163039	1813765	1800295	13471	98662037
24	163326	1812007	1798488	13519	98657236
25	163613	1810251	1796684	13567	98652535
26	163900	1808499	1794883	13615	98647734
27	164187	1806749	1793086	13664	98642933
28	164474	1805003	1791291	13712	98638132
29	164761	1803260	1789500	13761	98633331
30	165048	1801521	1787711	13809	98628630

Mm.

Deg. 80

Deg. 9 +1—

m.	Sines	Logarith.	Differen.	Logarit.	Sines.	
30	165048	1801521	1787711	13809	986286	30
31	165334	1799784	1785926	13858	986238	29
32	165621	1798050	1784143	13907	986189	28
33	165908	1796329	1782364	13956	986141	27
34	166195	1794592	1780587	14005	986093	26
35	166482	1792868	1778814	14054	986045	25
36	166769	1791146	1777043	14103	985996	24
37	167055	1789428	1775276	14152	985947	23
38	167342	1787713	1773511	14201	985899	22
39	167629	1786001	1771750	14251	985850	21
40	167916	1784291	1769991	14300	985801	20
41	168203	1782585	1768235	14350	985752	19
42	168489	1780882	1766482	14400	985703	18
43	168776	1779182	1764732	14449	985654	17
44	169063	1777484	1762985	14499	985605	16
45	169349	1775790	1761241	14549	985556	15
46	169636	1774098	1759499	14599	985507	14
47	169923	1772410	1757761	14649	985457	13
48	170209	1770724	1756025	14700	985408	12
49	170496	1769042	1754292	14750	985358	11
50	170783	1767362	1752562	14800	985309	10
51	171069	1765686	1750835	14851	985259	9
52	171356	1764012	1749111	14901	985209	8
53	171643	1762341	1747389	14952	985159	7
54	171929	1760673	1745670	15002	985109	6
55	172216	1759007	1743954	15053	985059	5
56	172502	1757345	1742241	15104	985009	4
57	172789	1755685	1740530	15155	984959	3
58	173075	1754028	1738822	15206	984909	2
59	173362	1752374	1737117	15257	984858	1
60	173648	1750723	1735415	15309	984808	0

Min.

Deg. 80

Deg. 10 +1

	Sines	Logarith.	Differen.	Logarit.	Sines.	
0	173648	1750723	1735415	15309	984808	60
1	173935	1749075	1733715	15360	984757	59
2	174221	1747430	1732018	15411	984707	58
3	174507	1745787	1730324	15463	984656	57
4	174794	1744147	1728632	15515	984605	56
5	175080	1742519	1726943	15566	984554	55
6	175367	1740875	1925257	15618	984503	54
7	175653	1739244	1723574	15670	984452	53
8	175939	1737615	1721893	15722	984401	52
9	176226	1735989	1720215	15774	984350	51
10	176512	1734365	1718539	15826	984298	50
11	176798	1732744	1716866	15878	984247	49
12	177085	1731126	1715196	15931	984196	48
13	177371	1729511	1713528	15983	984144	47
14	177657	1727898	1711863	16035	984092	46
15	177943	1726288	1710200	16088	984041	45
16	178230	1724681	1708540	16141	983989	44
17	178516	1723076	1706883	16193	983937	43
18	178802	1721474	1705228	16246	983885	42
19	179088	1719875	1703576	16299	983833	41
20	179375	1718278	1701926	16352	983781	40
21	179661	1716684	1700279	16405	983729	39
22	179947	1715093	1698634	16458	983676	38
23	180233	1713504	1696992	16512	983624	37
24	180519	1711918	1695353	16565	983571	36
25	180805	1710334	1693716	16618	983519	35
26	181091	1708753	1692081	16672	983466	34
27	181377	1707175	1690449	16725	983414	33
28	181663	1705599	1688819	16779	983360	32
29	181949	1704025	1687192	16833	983308	31
30	182235	1702454	1685568	16887	983255	30

Min.

Deg. 79

Deg. 10



m.	Sines	Logarith.	Differen.	Logarit.	Sines.	
30	182235	1702455	1635568	16887	983255	30
31	182521	1700887	1683946	16941	983202	29
32	182807	1699221	1682326	16994	983149	28
33	183093	1697758	1680709	17049	983096	27
34	183379	1696197	1679094	17103	983042	26
35	183665	1694639	1677482	17157	982989	25
36	183951	1693084	1675872	17212	982935	24
37	184237	1691530	1674264	17266	982882	23
38	184523	1689980	1672659	17321	982828	22
39	184809	1688432	1671056	17376	982774	21
40	185095	1686886	1669456	17430	982721	10
41	185381	1685343	1667858	17485	982667	19
42	185667	1683802	1666262	17540	982613	18
43	185952	1682264	1664669	17595	982559	17
44	186238	1680728	1663078	17650	982505	16
45	186524	1679195	1661489	17705	982450	15
46	186810	1677664	1659903	17761	982396	14
47	187096	1676135	1658319	17816	982342	13
48	187381	1674609	1656737	17871	982287	12
49	187667	1673085	1655158	17927	982233	11
50	187953	1671564	1653581	17983	982178	10
51	188238	1670045	1652007	18038	982123	9
52	188524	1668529	1650434	18094	982069	8
53	188810	1667014	1648864	18150	982014	7
54	189095	1665503	1647297	18206	981959	6
55	189381	1663993	1645731	18262	981904	5
56	189667	1662486	1644168	18318	981849	4
57	189952	1660982	1642607	18374	981793	3
58	190238	1659479	1641049	18431	981738	2
59	190523	1657979	1639492	18487	981683	1
60	190809	1656482	1637938	18544	981627	0

Min.

Deg. 79

Deg. 11



m	Sines	Logarith	Differen.	Logarit	Sines.	
0	190809	165648	1637938	18544	981627	60
1	191094	165498	1636386	18600	981572	59
2	191380	1653493	1634836	18657	981516	58
3	191665	165200	1633289	18714	981460	57
4	191951	165051	1631744	18770	981404	56
5	192236	164902	163020	18827	981349	55
6	192522	164754	162866	18884	981293	54
7	192807	164606	1627121	18941	981237	53
8	193093	164458	1625581	18999	981181	52
9	193378	164310	1624051	19056	981124	51
10	193664	164163	1622518	19113	981068	50
11	193949	164016	1620989	19171	981012	49
12	194234	163868	1619461	19228	980955	48
13	194520	163722	1617935	19286	980899	47
14	194805	1635756	1616412	19344	980842	46
15	195090	1634292	1614891	19402	980785	45
16	195376	1632831	1613372	19459	980728	44
17	195661	1631372	1611854	19517	980672	43
18	195946	1629915	1610339	19576	980615	42
19	196231	1628460	1608827	19634	980558	41
20	196517	1627008	1607316	19692	980501	40
21	196802	1625550	1605807	19750	980443	39
22	197087	1624109	1604301	19809	980386	38
23	197372	1622664	1602796	19867	980329	37
24	197657	1621220	1601294	19926	980271	36
25	197942	1619778	1599794	19984	980214	35
26	198228	1618339	1598295	20043	980156	34
27	198513	1616902	1596799	20102	980098	33
28	198798	1615466	1595305	20161	980041	32
29	199083	1614034	1593813	20220	979983	31
30	199368	1612603	1592323	20279	979925	30

Min.

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Deg. 11

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m	Sines.	Logarith	Differen	Logarit.	Sines.
30	199368	1612603	1592323	20279	979925
31	199653	1611174	1590835	20339	979867
32	199938	1609748	1589350	20398	979809
33	200223	1608323	1587866	20457	979750
34	200508	1606901	1586384	20517	979692
35	200793	1605481	1584904	20576	979634
36	201078	1604062	1583426	20636	979575
37	201363	1602646	1581950	20696	979517
38	201648	1601232	1580476	20756	979458
39	201933	1599820	1579005	20816	979399
40	202218	1598411	1577535	20876	979341
41	202503	1597002	1576067	20936	979282
42	202787	1595597	1574601	20996	979223
43	203072	1594194	1573137	21056	979164
44	203357	1592792	1571675	21117	979105
45	203642	1591393	1570215	21177	979046
46	203927	1589995	1568757	21238	978986
47	204211	1588600	1567301	21298	978927
48	204496	1587206	1565846	21359	978867
49	204781	1585815	1564395	21420	978808
50	205066	1584425	1562944	21481	978749
51	205350	1583037	1561493	21542	978689
52	205635	1581652	1560049	21603	978629
53	205920	1580269	1558604	21664	978569
54	206204	1578887	1557162	21725	978509
55	206489	1577508	1555721	21787	978449
56	206774	1576127	1554282	21848	978389
57	207058	1574750	1552840	21910	978329
58	207343	1573382	1551411	21971	978268
59	207627	1572011	154997	22033	978208
60	207912	1570641	1548547	22095	978148

Min.

Deg. 78

Deg. 12 +1—

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	207912	1570641	1548547	22095	978148
1	208196	1569274	1547117	22157	978087
2	208481	1567908	1545690	22219	978026
3	208765	1566544	1544264	22281	977966
4	209050	1565183	1542840	22343	977905
5	209334	1563823	1541418	22405	977844
6	209618	1562465	1539998	22467	977783
7	209903	1561109	1538580	22530	977722
8	210187	1559755	1537163	22592	977661
9	210472	1558403	1535748	22655	977600
10	210756	1557053	1534336	22717	977539
11	211040	1555705	1532925	22780	977477
12	211325	1554358	1531515	22843	977416
13	211609	1553014	1530108	22906	977354
14	211893	1551671	1528703	22969	977293
15	212178	1550331	1527299	23032	977231
16	212462	1548992	1525897	23095	977169
17	212746	1547655	1524497	23158	977107
18	213030	1546320	1523098	23222	977046
19	213315	1544987	1521701	23285	976984
20	213599	1543655	1520306	23349	976921
21	213883	1542326	1518913	23413	976859
22	214167	1540998	1517522	23476	976797
23	214451	1539672	1516132	23540	976735
24	214735	1538348	1514744	23604	976672
25	215019	1537026	1513358	23668	976610
26	215303	1535706	1511974	23732	976547
27	215588	1534387	1510591	23796	976484
28	215872	1533071	1509210	23861	976422
29	216156	1531756	1507831	23925	976359
30	216440	1530443	1506453	23989	976297

Min.

Deg. 77

Deg. 12 + 1 —

m	Sines.	Logarith.	Differen.	Logarit.	Sines.
30	216440	1530443	1506453	23989	976296
31	216724	1529132	1505078	24054	976233
32	217008	1527823	1503704	24119	976170
33	217292	1526515	1502332	24183	976107
34	217575	1525209	1500961	24248	976043
35	217859	1523905	1499592	24313	975980
36	218143	1522603	1498225	24378	975917
37	218427	1521302	1496859	24443	975853
38	218711	1520004	1495495	24508	975790
39	218995	1518707	1494133	24573	975726
40	219279	1517412	1492773	24639	975662
41	219562	1516118	1491414	24704	975598
42	219846	1514827	1490057	24770	975535
43	220130	1513537	1488701	24835	975470
44	220414	1512248	1487347	24901	975406
45	220697	1510962	1485995	24967	975342
46	220981	1509677	1484645	25033	975278
47	221265	1508394	1483296	25099	975214
48	221548	1507113	1481946	25165	975149
49	221832	1505834	1480603	25231	975085
50	222116	1504556	1479259	25297	975020
51	222400	1503280	1477917	25363	974956
52	222683	1502006	1476576	25430	974891
53	222967	1500733	1475237	25496	974826
54	223250	1499462	1473899	25563	974761
55	223534	1498193	1472563	25629	974696
56	223817	1496925	1471229	25696	974631
57	224101	1495659	1469896	25763	974566
58	224384	1494395	1468565	25830	974501
59	224668	1493132	1467235	25897	974435
60	224951	1491872	1465908	25964	974370

Min.

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Deg. 13 + —

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	224951	1491872	1465907	25964	97437060
1	225234	1490612	1464581	26031	97430459
2	225518	1489355	1463256	26097	97423958
3	225801	1488099	1461933	26166	97417357
4	226085	1486845	1460612	26234	97410856
5	226368	1485593	1459291	26301	97404255
6	22665	1484341	1457973	26369	97397654
7	226935	1483093	1456656	26436	97391053
8	227217	1481845	1455341	26504	97384452
9	227501	1480599	1454027	26572	97377851
10	227784	1479355	1452715	26640	97371150
11	228068	1478113	1451405	26708	97364549
12	228351	1476872	1450095	26776	97357948
13	228634	1475632	1448788	26845	97351237
14	228917	1474395	1447482	26913	97344646
15	229200	1473158	1446177	26981	97337945
16	229483	1471924	1444874	27050	97331244
17	229767	1470691	1443572	27118	97324643
18	230050	1469459	1442274	27187	97317942
19	230332	1468230	1440974	27256	97311241
20	230616	1467001	1439677	27325	97304540
21	230894	1465775	1438381	27394	97297839
22	231181	1464550	1437087	27463	97291038
23	231465	1463326	1435794	27532	97284337
24	231748	1462104	1434503	27601	97277636
25	232030	1460884	1433213	27671	97270835
26	232314	1459665	1431925	27740	97264034
27	232597	1458448	1430638	27810	97257233
28	232880	1457233	1429353	27879	97250432
29	233162	1456019	1428070	27949	97243631
30	233445	1454807	1426788	28019	97236830

Min

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Deg. 13 + —

m.	Sines.	Logarith.	Differen	Logarit.	Sines.
30	233445	1454807	1426788	28019	972370
31	233728	1453596	1425507	28089	972302
32	234011	1452387	1424228	28159	972234
33	234294	1451179	1422950	28229	972166
34	234577	1449973	1421674	38299	972098
35	234859	1448768	1420399	28369	972029
36	235142	1447565	1419125	28439	971961
37	235425	1446363	1417853	28510	971893
38	235707	1445163	1416583	28580	971824
39	235990	1443965	1415313	28651	971755
40	236273	1442767	1414046	28722	971687
41	236555	1441572	1412779	28792	971618
42	236838	1440378	1411514	28863	971549
43	237121	1439185	1410251	28934	971480
44	237403	1437994	1408989	29005	971411
45	237686	1436805	1407728	29076	971342
46	237968	1435616	1406469	29148	971272
47	238251	1434430	1405211	29219	971204
48	238533	1433245	1403955	29290	971134
49	238816	1432062	1402700	29362	971065
50	239098	1430880	1401446	29433	970995
51	239381	1429699	1400194	29505	970926
52	239663	1428520	1398943	29577	970856
53	239946	1427342	1397693	29649	970786
54	240228	1426166	1396445	29721	970716
55	240510	1424991	1395199	29792	970647
56	240793	1423818	1393953	29865	970577
57	241075	1422646	1392709	29937	970506
58	241357	1421476	1391467	30009	970436
59	241640	1420307	1390225	30082	970366
60	241922	1419140	1388985	30154	970296

Min

Deg. 76

Deg. 14 + —

mi.	Sines.	Logarith.	Differen.	Logarit.	Sines.
0	241922	1419140	1388085	30154	97029660
1	242204	1417974	1387747	30227	97022559
2	242486	1416809	1386509	30300	97015558
3	242768	1415646	1385274	30372	97008457
4	243051	1414484	1384039	30445	97001356
5	243333	1413324	1382806	30518	96994355
6	243615	1412165	1381574	30591	96987254
7	243897	1411008	1380344	30664	96980153
8	244179	1409852	1379115	30737	96973052
9	244461	1408698	1377887	30811	96965951
10	244743	1407545	1376661	30884	96958850
11	245025	1406393	1375435	30958	96951749
12	245307	1405243	1374212	31031	96944648
13	245589	1404094	1372989	31105	96937547
14	245871	1402946	1371768	31179	96930446
15	246153	1401800	1370548	31252	96923345
16	246435	1400656	1369329	31326	96916244
17	246717	1399512	1368112	31400	96909143
18	246999	1398370	1366896	31474	96902042
19	247281	1397230	1365681	31549	96894941
20	247563	1396091	1364468	31623	96887840
21	247845	1394953	1363256	31697	96880739
22	248126	1393817	1362045	31772	96873638
23	248408	1392682	1360835	31846	96866537
24	248690	1391548	1359627	31921	96859436
25	248972	1390416	1358420	31996	96852335
26	249253	1389285	1357214	32070	96845234
27	249535	1388155	1356010	32145	96838133
28	249817	1387027	1354807	32220	96831032
29	250098	1385900	1353605	32295	96823931
30	250380	1384775	1352404	32371	96816830

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Deg. 75

Deg. 14 +1-

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m.	Sines.	Logarithb.	Differenz.	Logarithb.	Sines.
30	250380	1384775	1352404	32371	668148
31	250663	1383651	1351205	32446	968075
32	250943	1382528	1350007	32521	968002
33	251225	1381407	1348810	32597	967929
34	251506	1380286	1347614	32672	967856
35	251788	1379168	1346420	32748	967782
36	252069	1378050	1345227	32824	967709
37	252351	1376934	1344035	32899	967636
38	252632	1375819	1342844	32975	967562
39	252914	1374706	1341655	33051	967489
40	253195	1373594	1340466	33127	967415
41	253477	1372483	1339280	33204	967341
42	253758	1371374	1338094	33280	967268
43	254039	1370266	1336910	33356	967194
44	254321	1369159	1335726	33433	967120
45	254602	1368053	1334544	33509	967046
46	254883	1366949	1333363	33586	966972
47	255164	1365846	1332184	33663	966898
48	255446	1364744	1331005	33739	966823
49	255727	1363644	1329828	33816	966749
50	256008	1362545	1328652	33893	966675
51	256289	1361447	1327477	33970	966600
52	256571	1360351	1326303	34048	966525
53	256852	1359256	1325131	34125	966451
54	257133	1358162	1323960	34202	966376
55	257414	1357069	1322790	34280	966301
56	257695	1355978	1321621	34357	966226
57	257976	1354888	1320453	34435	966151
58	258257	1353799	1319287	34513	966076
59	258538	1352711	1318121	34590	966001
60	258819	1351625	1316957	34668	965926

Min.

Deg. 75

Deg. 15

+1—

mi	Sines.	Logari. b	Differen.	Logarit.	Sines.
0	258819	1351625	1316557	34668	96592760
1	259100	1350541	1315794	34746	96585059
2	259381	1349457	1314633	34824	96577558
3	259662	1348375	1313472	34903	96470057
4	259943	1347293	1312313	34980	96462456
5	260224	1346213	1311154	35059	96554855
6	260504	1345135	1309997	35137	96547354
7	260785	1344057	1308841	35216	96539653
8	261066	1342981	1307686	35295	96532152
9	261347	1341906	1306533	35373	96524551
10	261628	1340832	1305380	35452	96516950
11	261908	1339760	1304229	35531	96509349
12	262189	1338688	1303078	35610	96501648
13	262470	1337618	1301929	35689	96494047
14	262750	1336549	1300781	35768	96486446
15	263031	1335482	1299634	35848	96478755
16	263312	1334415	1298488	35927	96471144
17	263592	1333350	1297344	36006	96463443
18	263873	1332286	1296200	36086	96455742
19	264154	1331224	1295058	36165	96448141
20	264434	1330162	1293917	36245	96440340
21	264715	1329102	1292777	36325	96432739
22	264995	1328043	1291638	36405	96425038
23	265276	1326985	1290500	36485	96417337
24	265556	1325929	1289364	36565	96409536
25	265837	1324873	1288228	36645	96401835
26	266117	1323819	1287094	36725	96394134
27	266397	1322766	1285960	36806	96386333
28	266678	1321714	1284828	36886	96378632
29	266958	1320663	1283696	36967	96370831
30	267238	1319614	1282566	37047	96363030

M12.

Deg. 74

Deg. 15

41—

m.	Sines.	Logarith	Differen.	Logarit.	Sines.	
30	267238	1319613	1282566	37047	963630	30
31	267519	1318565	1281437	37128	963553	29
32	267799	1317518	1280309	37209	963475	28
33	268079	1316472	1279182	37290	963397	27
34	268359	1315427	1278056	37371	963319	26
35	268640	1314383	1276932	37452	963241	25
36	268920	1313341	1275808	37533	963162	24
37	269200	1312300	1274686	37614	963084	23
38	269480	1311259	1273564	37696	963006	22
39	269760	1310221	1272444	37777	962927	21
40	270040	1309183	1271325	37859	962849	20
41	270320	1308146	1270206	37940	962772	19
42	270600	1307111	1269089	38022	962692	18
43	270880	1306077	1267973	38104	962613	17
44	271160	1305044	1266858	38186	962534	16
45	271440	1304012	1265744	38268	962455	15
46	271720	1302981	1264631	38350	962376	14
47	272000	1301951	1263519	38432	962297	13
48	272280	1300922	1262409	38514	962218	12
49	272560	1299895	1261299	38597	962139	11
50	272840	1298869	1260190	38679	962059	10
51	273120	1297844	1259082	38762	961980	9
52	273400	1296820	1257976	38844	961900	8
53	273679	1295797	1256870	38927	961821	7
54	273959	1294775	1255766	39010	961741	6
55	274239	1293754	1254662	39092	961662	5
56	274519	1292735	1253560	39176	961582	4
57	274798	1291717	1252458	39259	961502	3
58	275078	1290699	1251358	39342	961422	2
59	275350	1289683	1250259	39425	961342	1
30	275637	1288668	1249160	39509	961262	0

M.

G

Deg. 74

Deg. 16 +

M.	Sines.	Logarith.	Differen	Logarit	Sines
0	275637	1288669	1249160	39509	96126260
1	275917	1287655	1248063	39591	96118159
2	276196	1286642	1246967	39676	96110158
3	276476	1285631	1245871	39759	96102157
4	276756	1284620	1244777	39843	96094056
5	277035	1283610	1243684	39927	96086055
6	277315	1282602	1242591	40010	96079054
7	277594	1281595	1241500	40095	96069853
8	277873	1280589	1240410	40179	96061852
9	278153	1279583	1239320	40263	96053751
10	278432	1278579	1238232	40347	96045650
11	278712	1277577	1237145	40432	96037549
12	278991	1276575	1236059	40516	96029448
13	279270	1275574	1234973	40601	96021347
14	279550	1274574	1233889	40685	96013146
15	279830	1273576	1232806	40770	96005045
16	280108	1272578	1231723	40855	95996844
17	280387	1271582	1230642	40940	95988743
18	280667	1270587	1229562	41025	95980542
19	280946	1269592	1228483	41110	95972441
20	281225	1268599	1227404	41195	95964240
21	281504	1267607	1226327	41280	95956039
22	281783	1266617	1225251	41366	95947838
23	282062	1265627	1224175	41451	95939637
24	282341	1264638	1223101	41537	95931436
25	282624	1263650	1222027	41623	95923235
26	282899	1262663	1220955	41708	95914934
27	283178	1261678	1219783	41794	95906733
28	283457	1260693	1218813	41880	95898532
29	283736	1259709	1217743	41966	95890231
30	284015	1258727	1216675	42052	95882030

Min

Deg. 73

Deg. 16

+ | -

	Sines	Logarith	Differen.	Logarit	Sines	
30	284015	1258727	1216675	42052	958820	30
31	284294	1257745	1215607	42138	958737	29
32	284573	1256765	1214540	42225	958654	28
33	284852	1255785	1213474	42311	958572	27
34	285131	1254807	1212409	42397	958489	26
35	285410	1253830	1211345	42484	958406	25
36	285688	1252853	1210282	42571	958323	24
37	285967	1251878	1209220	42658	958239	23
38	286246	1250904	1208159	42744	958156	22
39	286525	1249930	1207099	42831	958073	21
40	286803	1248958	1206040	42918	957990	20
41	287082	1247987	1204982	43005	957906	19
42	287360	1247017	1203925	43093	957822	18
43	287639	1246048	1202868	43180	957739	17
44	287918	1245080	1201813	43267	957655	16
45	288196	1244113	1200758	43355	957571	15
46	288475	1243147	1199705	43442	957487	14
47	288753	1242182	1198652	43530	957404	13
48	289032	1241218	1197600	43618	957320	12
49	289310	1240255	1196549	43706	957235	11
50	289589	1239293	1195500	43794	957151	10
51	289867	1238332	1194451	43882	957067	9
52	290146	1237372	1193402	43970	956983	8
53	290424	1236413	1192355	44058	956898	7
54	290702	1235455	1191309	44146	956814	6
55	290981	1234498	1190264	44235	956729	5
56	291259	1233542	1189219	44323	956644	4
57	291537	1232588	1188176	44412	956560	3
58	291815	1231634	1187133	44501	956475	2
59	292093	1230681	1186091	44590	956390	1
60	292372	1229728	1185050	44679	956305	0

Min

Deg. 17 + —

m	Sines.	Logarith.	Differen.	Logarit	Sines.
0	92372	1229729	1185050	44678	95630560
1	292650	1228778	1184010	44767	95622059
2	292928	1227828	1182971	44858	95613458
3	293206	1226879	1181933	44945	95604957
4	293484	1225931	1180896	45035	95596456
5	293762	1224984	1179859	45124	95587855
6	294040	1224038	1178824	45214	95579354
7	294318	1223093	1177789	45303	95570753
8	294596	1222149	1176756	45393	95562252
9	294874	1221206	1175723	45482	95553651
10	295152	1220263	1174691	45572	95545050
11	295430	1219322	1173660	45662	95536449
12	295708	1218382	1172629	45752	95527848
13	295986	1217443	1171600	45842	95519247
14	296263	1216504	1170572	45932	95510646
15	296542	1215567	1169544	46023	95502045
16	296819	1214631	1168517	46113	95493444
17	297097	1213695	1167491	46204	95484743
18	297375	1212761	1166466	46294	95476142
19	297653	1211828	1165442	46385	95467441
20	297930	1210895	1164419	46475	95458840
21	298208	1209964	1163397	46566	95450139
22	298486	1209033	1162376	46657	95441438
23	298763	1208104	1161355	46748	95432737
24	299041	1207175	1160335	46839	95424036
25	299318	1206247	1159316	46930	95415335
26	299596	1205320	1158298	47022	95406634
27	299873	1204394	1157281	47113	95397933
28	300151	1203470	1156265	47205	95389232
29	300428	1202546	1155249	47296	95380431
30	300706	1201622	1154234	47388	95371730

Min.

Deg. 72

Deg. 17



m.	Sines	Logarith.	Differen.	Logarit	Sines
30	300706	1201622	1154234	47388	953717
31	300983	1200700	1153220	47480	953629
32	301261	1199779	1152207	47572	953542
33	301538	1198859	1151195	47664	953454
34	301815	1197940	1150183	47756	953366
35	302092	1197021	1149173	47848	953279
36	302370	1196104	1148163	47940	953191
37	302647	1195187	1147154	48033	953103
38	302924	1194272	1146146	48125	953015
39	303202	1193357	1145139	48218	952926
40	303478	1192443	1144133	48310	952838
41	303756	1191530	1143127	48403	952750
42	304033	1190618	1142123	48496	952661
43	304310	1189707	1141119	48589	952573
44	304587	1188797	1140116	48682	952484
45	304864	1187888	1139113	48775	952396
46	305141	1186980	1138112	48868	952307
47	305418	1186072	1137111	48961	952218
48	305695	1185166	1136111	49054	952129
49	305972	1184260	1135112	49148	952040
50	306249	1183356	1134114	49241	951951
51	306526	1182452	1133117	49335	951862
52	306803	1181549	1132121	49429	951773
53	307080	1180647	1131125	49522	951684
54	307357	1179746	1130130	49616	951594
55	307633	1178846	1129136	49710	951505
56	307910	1177947	1128142	49804	951415
57	308187	1177048	1127150	49899	951326
58	308464	1176151	1126158	49993	951236
59	308740	1175254	1125167	50087	951146
60	309017	1174359	1124177	50181	951056

M. n.

Deg. 18

+1-

m.	Sines.	Logarith	Differen	Logarit	Sines
0	3090171	1174359	1124177	50182	95105660
1	309294	1173464	1123187	50276	95096759
2	309570	1172570	1122199	50371	95087758
3	309847	1171677	1121211	50466	95078757
4	310123	1170785	1120224	50561	95069656
5	310400	1169893	1119238	50656	95060655
6	310676	1169003	1118252	50751	95051654
7	310953	1168113	1117268	50846	95042543
8	311229	1167225	1116284	50941	95033552
9	311506	1166337	1115301	51036	95024451
10	311782	1165450	1114318	51132	95015450
11	312059	1164564	1113337	51227	95006349
12	312335	1163679	1112356	51323	94997248
13	312611	1162794	1111376	51418	94988147
14	312887	1161911	1110397	51514	94979046
15	313164	1161028	1109418	51610	94969945
16	313440	1160147	1108440	51706	94960844
17	313716	1159266	1107464	51802	94951743
18	313992	1158386	1106488	51898	94942542
19	314269	1157507	1105512	51994	94933441
20	314545	1156628	1104538	52091	94924340
21	314821	1155751	1103564	52187	94915139
22	315097	1154875	1102591	52284	94906038
23	315373	1153999	1101618	52380	94896837
24	315649	1153124	1100647	52477	94887636
25	315925	1152250	1099676	52574	94878435
26	316201	1151377	1098706	52670	94869234
27	316477	1150504	1097737	52768	94860033
28	316753	1149633	1096768	52865	94850832
29	317029	1148762	1095800	52962	94841631
30	317305	1147893	1094833	53059	94832430

Min.

Deg. 71

Deg. 18

+1—

m	Sines	Logarith.	Differen.	Logarit.	Sines	
30	317305	1147893	1094833	53059	948324	30
31	317580	1147024	1093867	53157	948231	29
32	317856	1146156	1092901	53254	948139	28
33	318132	1145288	1091936	53352	948046	27
34	318408	1144422	1090972	53450	947954	26
35	318684	1143556	1090009	53547	947861	25
36	318959	1142691	1089046	53645	947768	24
37	319235	1141827	1088084	53743	947676	23
38	319511	1140964	1087123	53841	947583	22
39	319786	1140102	1086163	53939	947490	21
40	320062	1139241	1085203	54037	947397	20
41	320337	1138380	1084244	54136	947303	19
42	320613	1137520	1083286	54234	947210	18
43	320888	1136661	1082329	54332	947117	17
44	321164	1135803	1081372	54431	947024	16
45	321439	1134946	1080416	54530	946930	15
46	321715	1134089	1079460	54629	946837	14
47	321990	1133233	1078506	54727	946743	13
48	322266	1132378	1077552	54826	946649	12
49	322541	1131524	1076599	54926	946555	11
50	322816	1130671	1075646	55025	946462	10
51	323092	1129819	1074694	55124	946368	9
52	323367	1128967	1073743	55224	946274	8
53	323642	1128116	1072793	55323	946180	7
54	323917	1127266	1071844	55423	946085	6
55	324193	1126417	1070895	55522	945991	5
56	324468	1125569	1069947	55622	945897	4
57	324743	1124721	1068999	55722	945802	3
58	325018	1123874	1068053	55822	945708	2
59	325293	1123028	1067107	55922	945613	1
60	325568	1122183	1066161	56022	945519	0

Min

G 4

Deg. 71

Deg. 19

+1-

m.	Sines.	Logarith.	Differen	Logarit.	Sines
0	325568	1122183	1066161	56022	94551960
1	325843	1121339	1065217	56122	94542459
2	326118	1120495	1064273	56222	94532958
3	326393	1119652	1063330	56323	94523457
4	326668	1118810	062387	56423	94513956
5	326943	1117969	2061445	56524	94504455
6	327218	1117129	1060504	56624	94494954
7	327493	1116289	1059564	56725	94485443
8	327767	1115450	1058624	56826	94475852
9	328042	1114612	1057685	56927	94466351
10	328317	1113775	1056747	57028	94456850
11	328592	1112938	1055809	57129	94447249
12	328866	1112102	1054872	57230	94437648
13	329141	1111267	1053936	57332	94428147
14	329416	1110433	1053000	57433	94418546
15	329691	1109600	1052065	57534	94408945
16	329965	1108767	1051131	57636	94399344
17	330240	1107936	1050198	57738	94389743
18	330514	1107105	1049265	57840	94380142
19	330789	1106274	1048333	57942	94370541
20	331063	1105445	1047401	58044	94360840
21	331338	1104616	1046470	58146	94351239
22	331612	1103788	1045540	58248	94341638
23	331887	1102961	1044611	58350	94331937
24	332161	1102135	1043682	58453	94322336
25	332435	1101309	1042754	58555	94312635
26	332710	1100484	1041826	58658	94302934
27	332984	1099660	1040899	58761	94293233
28	333258	1098837	1039973	58863	94283632
29	333533	1098014	1039048	58966	94273931
30	333807	1097192	1038123	59069	94264130

Min.

Deg. 70

Deg. 19 +/—

mi	Sines	Logarith.	Differen	Logarit.	Sines
30	333807	1097192	1038123	59069	942641
31	334081	1096371	1037199	59172	942544
32	334355	1095551	1036276	59275	942447
33	334629	1094731	1035353	59378	942350
34	334903	1093912	1034430	59482	942252
35	335178	1093094	1033509	59585	942155
36	335452	1092277	1032588	59689	942057
37	335726	1091461	1031668	59792	941960
38	336000	1090645	1030749	59896	941862
39	336274	1089830	1029830	60000	941764
40	336547	1089016	1028911	60104	941666
41	336821	1088202	1027994	60208	941568
42	337095	1087389	1027077	60312	941470
43	337369	1086577	1026161	60416	941372
44	337643	1085766	1025245	60520	941274
45	337917	1084955	1024330	60625	941176
46	338190	1084146	1023416	60730	941078
47	338464	1083337	1022502	60834	940979
48	338738	1082528	1021589	60939	940881
49	339011	1081721	1820677	61044	940782
50	339285	1080914	1019765	61148	940684
51	339559	1080107	1018854	61253	940585
52	339832	1079302	1017944	61358	940486
53	340106	1078497	1017034	61463	940387
54	340379	1077693	1016125	61569	940288
55	340653	1076890	1015216	61674	940189
56	340926	1076088	1014308	61779	940090
57	341200	1075286	1013401	61885	939991
58	341473	1074485	1012494	61991	939891
59	341747	1073685	1011588	62097	939792
60	342020	1072885	1010683	62202	939693

Min.

G 5

Deg. 70

Deg. 20

m.	Sines	Logarith	Differen.	Logarit.	Sines
0	342020	107283	1010683	62202	939693 60
1	342293	1072086	1009778	62308	939593 59
2	342567	1071288	1008874	62414	939493 58
3	342840	1070491	1007971	62520	939394 57
4	343113	1069694	1007068	62627	939294 56
5	343386	1068898	1006165	62733	939194 55
6	343660	1068103	1005264	62839	939094 54
7	343933	1067308	1004363	62946	938994 53
8	344206	1066515	1003462	63052	938894 52
9	344479	1065722	1002562	63159	938794 51
10	344752	1064929	1001663	63266	938694 50
11	345025	1064137	1000765	63373	938593 49
12	345298	1063346	999867	63480	938493 48
13	345571	1062556	998969	63587	938392 47
14	345844	1061767	998072	63694	938292 46
15	346117	1060978	997176	63801	938191 45
16	346390	1060190	996281	63909	938091 44
17	346663	1059402	995386	64016	937990 43
18	346936	1058616	994492	64124	937889 42
19	347208	1057830	993598	64231	937788 41
20	347481	1057044	992705	64339	937687 40
21	347754	1056260	991813	64447	937586 39
22	348027	1055476	990921	64555	937485 38
23	348299	1054693	990030	64662	937383 37
24	348572	1053910	989140	64771	937282 36
25	348845	1053129	988250	64879	937181 35
26	349117	1052347	987360	64987	937079 34
27	349390	1051567	986471	65096	936977 33
28	349662	1050787	985583	65204	936876 32
29	349934	1050008	984695	65313	936774 31
30	350207	1049229	983808	65422	936672 30

Min

Deg. 69

Deg. 20 +1—

m	Sines	Logarith.	Differen	Logarith.	Sines	
30	350207	1049229	983808	65422	936672	30
31	350480	1048452	982921	65531	936570	29
32	350752	1047674	982035	65640	936468	28
33	351025	1046898	981149	65749	936366	27
34	351297	1046122	980265	65858	936264	26
35	351569	1845348	979381	65967	936162	25
36	351842	1044573	978497	66076	936059	24
37	352114	1043800	977614	66186	935957	23
38	352386	1043027	976732	66295	935855	22
39	352658	1042255	975850	66405	935752	21
40	352931	1041484	974969	66514	935649	20
41	353203	1040713	974089	66624	935547	19
42	353475	1039943	973209	66734	935444	18
43	353747	1039173	972330	66844	935341	17
44	354019	1038405	971451	66954	935238	16
45	354291	1037637	970573	67064	935135	15
46	354563	1036869	969695	67174	935032	14
47	354835	1036102	968818	67284	934929	13
48	355107	1035336	967941	67395	934826	12
49	355379	1034571	967065	67506	934722	11
50	355651	1033806	966189	67616	934619	10
51	355923	1033041	965314	67727	934515	9
52	356194	1032278	964440	67838	934412	8
53	356466	1031515	963566	67949	934308	7
54	356738	1030753	962693	68060	934204	6
55	357010	1029992	961820	68171	934101	5
56	357281	1029231	960948	68282	933997	4
57	357553	1828471	960077	68394	933893	3
58	357825	1027711	959206	68505	933789	2
59	358096	1026953	958336	68617	933685	1
60	358368	1026195	957466	68728	933580	0

Min.

Deg. 69

Deg. 21

m.	Sines	Logarith.	Differen.	Logarit.	Sines
0	353368	1026195	957466	68728	933580
1	358639	1025437	956597	68840	933476
2	358911	1024680	955729	68952	933372
3	359182	1023924	954861	96064	933267
4	359454	1023169	953993	96176	933163
5	359725	1022414	953126	96288	933058
6	359997	1021660	952260	69400	932953
7	360268	1020906	951394	69512	932849
8	360539	1020153	950529	69625	932744
9	360811	1019401	949664	69737	932639
10	361082	1018650	948800	69849	932534
11	361353	1017899	947937	69962	932429
12	361624	1017148	947074	70075	932324
13	361896	1016399	946211	70188	932219
14	362167	1015650	645349	70301	932113
15	362438	1014901	944488	70414	932008
16	362709	1014154	943627	70527	931902
17	362980	1013407	942766	70640	931797
18	363251	1012660	941907	70754	931691
19	363522	1011914	941047	70867	931586
20	363793	1011169	940189	70981	931480
21	364064	1010425	939330	71094	931374
22	364335	1009681	938473	71208	931268
23	364606	1008938	937616	71322	931162
24	364877	1008195	936759	71436	931056
25	365148	1007453	935903	71550	930950
26	365418	1006712	935048	71664	930843
27	365689	1005971	934193	71778	930737
28	365960	1005231	933339	71893	930631
29	366231	1004492	932485	72007	930524
30	366501	1003753	931631	72122	930418

Min

Deg. 68

Deg. 21 +

m.	Sines	Logarith.	Differen.	Logarit.	Sines.
30	366501	1003753	931631	72122	93041860
31	366772	1003015	930778	72236	93031159
32	367042	1002277	929926	72351	93020458
33	367313	1001540	929074	72466	93009757
34	367583	1000804	928223	72581	92999056
35	367854	1000068	927373	72696	92988455
36	368125	999333	926521	72811	92977754
37	368395	998599	925673	72926	92966953
38	368665	997865	924824	73041	92956252
39	368936	997132	923975	73157	92945551
40	369206	996400	923127	73272	92934850
41	369476	995668	922280	73388	92924049
42	369747	994937	921433	73504	92913348
43	370017	994206	920586	73619	92902547
44	370287	993476	919741	73735	92891746
45	370557	992747	918895	73851	92881045
46	370828	992018	918050	73967	92870244
47	371098	991290	917206	74084	92859443
48	371368	990562	916362	74200	92848642
49	371638	989835	915519	74316	92837841
50	371908	989109	914676	74433	92827040
51	372178	988383	913833	94549	92816139
52	372448	987658	912991	74666	92805338
53	372718	986933	912150	74783	92794537
54	372988	986209	911309	74900	92783636
55	373258	985486	910469	75017	92772835
56	373527	984763	909629	75134	92761934
57	373797	984041	908790	75251	92751033
58	374067	983319	907951	75368	92740232
59	374337	982599	907113	75486	92729331
60	374607	981878	906275	75603	92718430

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m.	Sines	Logarith	Differen.	Logarit.	Sines.	
0	374607	981878	906275	75603	927184	60
1	374876	981159	905438	75721	927075	59
2	375146	980440	904601	75838	626966	58
3	375416	979721	903765	75956	926857	57
4	375685	979004	902930	76074	926747	56
5	375955	978286	902094	76192	926638	55
6	376224	977570	901259	76310	926529	54
7	376494	976853	900425	76428	926419	53
8	376763	976138	899591	76547	926310	52
9	377033	975423	898758	76665	926200	51
10	377302	974709	897925	76783	926090	50
11	377571	973995	897093	76902	925980	49
12	377841	973282	896261	77021	925871	48
13	378110	972569	895430	77140	925761	47
14	378379	971857	894599	77259	925651	46
15	378649	971146	893769	77378	925541	45
16	378918	970435	892939	77497	925430	44
17	379187	969735	892120	77616	925320	43
18	379456	969016	891281	77735	925210	42
19	379725	968307	890453	77854	925099	41
20	379994	967599	889625	77974	924989	40
21	380263	966891	888798	78093	924878	39
22	380532	966184	887971	78213	924768	38
23	380801	965477	887145	78332	924657	37
24	381070	964771	886319	78452	924546	36
25	381339	964065	885493	78572	924435	35
26	381608	963360	884668	78692	924324	34
27	381877	962656	883844	78812	924213	33
28	382146	961952	883020	78933	924102	32
29	382415	961249	882196	79053	923991	31
30	382683	960547	881373	79174	923879	30

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Deg. 22 +1—

m.	Sines	Logarit.	Differē.	Logarit.	Sines.	
30	382683	960547	381373	79174	923879	30
31	382952	959845	380551	79294	923768	29
32	383221	659143	879728	79415	923657	28
33	383489	958443	378907	79536	923545	27
34	383758	957742	378086	79656	923434	26
35	384027	957043	377265	79777	923322	25
36	384295	956344	876445	79898	923210	24
37	384564	955645	875626	80019	923098	23
38	384832	954947	874806	80141	922987	22
39	385101	954250	873988	80262	922875	21
40	385369	953553	873170	80383	922762	20
41	385638	952857	872352	80505	922650	19
42	385906	952161	871534	80626	922538	18
43	386174	951466	870718	80748	922426	17
44	386443	950771	869901	80870	922313	16
45	386710	950077	869085	80992	922201	15
46	386979	949384	868270	81114	922088	14
47	387247	948691	867455	81236	921976	13
48	387515	947999	866640	81358	921863	12
49	387784	947307	865826	81481	921750	11
50	388052	946616	865013	81603	921638	10
51	388320	945925	864200	81726	921525	9
52	388588	945235	863388	81848	921412	8
53	388856	944546	862575	81971	921299	7
54	389124	943857	861763	82094	921185	6
55	389392	943169	860952	82217	921072	5
56	389660	942481	860141	82340	920959	4
57	389928	941794	859331	82463	920846	3
58	390195	941107	858521	82586	920732	2
59	390463	940421	857712	82709	920618	1
60	390731	939735	856903	82833	920505	0

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m	Sines	Logarit	Differē.	Logarit.	Sines	
0	390731	939735	356903	82833	920505	60
1	390999	939050	856094	82956	920391	59
2	331267	938366	355286	83080	920277	58
3	391534	937682	854478	83204	920163	57
4	391802	936999	853671	83327	920050	56
5	392070	936316	852865	83451	919936	55
6	392337	935634	352058	83575	919821	54
7	392605	934952	851252	83699	919707	53
8	392872	934271	350447	83824	919593	52
9	393140	933590	349642	63948	919479	51
10	393407	932910	848837	84073	919364	50
11	393675	932230	848033	84197	919250	49
12	393942	931552	847230	84322	919135	48
13	394209	630873	846426	84447	919021	47
14	394477	930195	845624	84572	918906	46
15	394744	929518	844821	84696	918791	45
16	395011	928841	844019	84821	918676	44
17	395278	928165	843218	84947	918561	43
18	395546	927489	842417	85072	918446	42
19	395813	926814	841617	85197	918331	41
20	396080	926139	840817	85322	918216	40
21	396347	925465	840017	85448	918101	39
22	396614	924791	839218	85574	917986	38
23	396881	924118	838419	85699	917870	37
24	397148	923446	837621	85825	917755	36
25	397415	922774	836823	85951	917639	35
26	397682	922103	836026	86077	917523	34
27	397949	921432	835229	86203	917408	33
28	398215	920761	834432	86329	917292	32
29	398482	920092	833636	86456	917176	31
30	398749	919423	832840	86582	917080	30

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m	Sines.	Logarit.	Differē.	Logarit.	Sines.	
30	378749	919423	832840	86582	917060	30
31	399016	918754	832045	86709	916944	29
32	339283	918086	831250	86836	916828	28
33	399549	917418	830456	86962	916712	27
34	399816	916751	829662	87089	916595	26
35	400082	916084	828868	87216	916477	25
36	400349	915418	828075	87343	916363	24
37	400616	914753	827283	87470	916246	23
38	400882	914088	826490	87597	916130	22
39	401149	913423	825699	87725	916013	21
40	401415	912759	824907	87952	915896	20
41	401681	912096	824116	87979	915780	19
42	401948	911433	823326	88107	915663	18
43	402214	910771	822536	88235	915546	17
44	402480	910109	821746	88363	915429	16
45	402647	909447	820957	88490	915311	15
46	403013	908786	820168	88619	915194	14
47	403279	908126	819379	88747	915077	13
48	403545	907466	818591	88875	914960	12
49	403811	906807	817804	89003	914842	11
50	404078	906148	817016	89132	914725	10
51	404344	905490	816229	89261	914607	9
52	404610	904832	815443	89389	914489	8
53	404876	904175	814657	89518	914372	7
54	405142	903518	813871	89647	914254	6
55	405407	902862	813086	89776	914136	5
56	405673	902207	812301	89905	914018	4
57	405939	901551	811517	90034	913900	3
58	406205	900897	810733	90163	913782	2
59	406471	900243	809950	90293	913664	1
60	406737	899589	809167	90422	913545	0

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m.	Sines.	Logarit.	Differē.	Logarit	Sines.
0	406737	899589	809167	90422	913545 60
1	407002	898936	808384	90552	913427 59
2	407268	898283	807602	90681	913309 58
3	407534	897631	806820	90811	913190 57
4	407799	896980	806039	90941	913072 56
5	408065	896329	805258	91071	912953 55
6	408330	895678	804477	91201	912834 54
7	408596	895028	803697	91331	912715 53
8	408861	894378	802917	91461	912596 52
9	409127	893729	802138	91592	912477 51
10	409392	893081	801358	91722	912358 50
11	409658	892433	800580	91852	912239 49
12	409923	891785	799802	91984	912120 48
13	410188	891138	799024	92114	912001 37
14	410454	890492	798247	92245	911881 46
15	410719	889846	797470	92376	911762 45
16	410984	889200	796693	92507	911642 44
17	411249	888555	795917	92639	911523 43
18	411514	887911	795141	92770	911403 42
19	411779	887267	794366	92901	911283 41
20	412045	886623	793591	93033	911164 40
21	412309	885980	792816	93164	911044 39
22	412575	885338	792042	93296	910924 38
23	412839	884696	791268	93428	910804 37
24	413104	884054	790495	93560	910684 36
25	413369	883413	789722	93692	910563 35
26	413634	882773	788949	93824	910443 34
27	413898	882133	788177	93956	910323 33
28	414164	881493	787405	94088	910202 32
29	414428	880854	786634	94221	910082 31
30	414693	880216	785863	94353	909961 30

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m	Sines.	Logarit.	Differē.	Logarit.	Sines.	
30	414693	880216	785863	94353	909961	30
31	414958	879578	785092	94486	909841	29
32	415223	878940	784322	94618	909720	28
33	415487	878303	783552	94751	909599	27
34	415752	877667	782782	94884	909478	26
35	416016	877031	782013	95017	909357	25
36	416281	876396	781246	95150	909236	24
37	416545	875760	780476	95283	909115	23
38	416810	875125	779708	95417	908994	22
39	417074	874492	778941	95550	908873	21
40	417338	873857	778174	95684	908751	20
41	417603	873224	777407	95818	908630	19
42	417867	872592	776640	95951	908508	18
43	418131	871959	775874	96085	908389	17
44	418395	871328	775108	96119	908265	16
45	418660	870696	774343	96353	908143	15
46	418924	870066	773578	96487	908021	14
47	419188	869435	772814	66622	907899	13
48	519452	868806	772050	96756	907777	12
49	419716	868176	771286	66890	907655	11
50	419980	867547	770523	97025	907533	10
51	420244	866919	769760	97159	907411	9
52	420508	866291	768997	97295	907289	8
53	420772	865664	768235	97429	907166	7
54	421036	865037	767473	97564	907044	6
55	421300	864411	766711	97699	906922	5
56	421563	86378	765950	97834	906799	4
57	421827	863159	765189	97970	906676	3
58	422091	862534	764429	98105	906553	2
59	422355	861910	763669	98241	906431	1
60	422618	861286	762909	98376	906308	0

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Deg. 25 + | -

m.	Sines.	Logarit	Differē.	Logarit	Sines
0	412618	861286	762909	98376	906308 60
1	422882	860662	762150	98512	906185 59
2	423145	860039	761391	98648	906062 58
3	423409	859416	760633	98784	905939 57
4	423672	858794	759874	98920	905815 56
5	423936	858172	759117	99056	905692 55
6	424199	857551	758359	99192	905569 54
7	424463	856931	757602	99328	905445 53
8	424726	856310	756846	99465	905322 52
9	424989	855690	756089	99601	905198 51
10	425253	855071	755333	99738	905075 50
11	425516	854452	754578	99875	904951 49
12	425779	853834	753822	100012	904827 48
13	426042	853216	753067	100149	904703 37
14	426306	852598	752313	100286	904579 46
15	426569	851981	751559	100423	904455 45
16	426832	851365	750805	100560	904331 44
17	427095	850749	750052	100697	904207 43
18	427358	850133	749299	100835	904082 42
19	427620	849518	748546	100972	903958 41
20	427884	848903	747794	101110	903834 40
21	428147	848289	747042	101247	903709 39
22	428410	847675	746290	101385	903585 38
23	428672	847062	745539	101523	903460 37
24	428935	846449	744788	101661	903335 36
25	429198	845837	744037	101799	903210 35
26	429461	845225	743287	101938	903086 34
27	429723	844613	742537	102076	902961 33
28	429986	844002	741788	102215	902836 32
29	430248	843392	741039	102353	902710 31
30	430511	842782	740290	102492	902585 30

Min.

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Deg. 25 +|-

m.	Sines.	Logarith	Differē.	Logarith.	Sines.
30	430511	842782	740290	102492	902585
31	430774	842172	739541	102631	902460
32	431036	841563	738793	102770	902335
33	431299	840954	738046	102909	902209
34	431561	840346	737298	103048	902084
35	431823	839728	736551	103187	901958
36	432086	839131	735804	103326	901833
37	432348	838524	735058	103466	901707
38	432610	837917	734312	103605	901581
39	432873	837311	733566	103745	901455
40	433135	836706	732821	103885	901329
41	433397	836101	732076	104025	901203
42	433659	835496	731332	104165	901077
43	433921	834892	730587	104305	900951
44	434183	834288	729843	104445	900824
45	434445	833685	729100	104585	900698
46	434707	833082	728357	104726	900572
47	434969	832480	727614	104866	900445
48	435231	831878	726871	105006	900319
49	435493	831276	726129	105147	900192
50	435755	830675	725387	105288	900065
51	436017	830075	724646	105429	899939
52	436278	829474	723905	105570	899812
53	436540	828875	723164	105711	899685
54	436802	828275	722423	105852	899558
55	437063	827676	721683	105993	899431
56	437325	827070	720943	106135	899303
57	437587	826488	720204	106276	899176
58	437848	825883	719465	106418	899049
59	438110	825285	718726	106559	898921
60	438371	824689	717987	106701	898795

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mi. Sines.	Logarit.	Differen	Logarit.	Sines.
0 438371	824689	717987	106701	89879460
1 438633	824093	717249	106843	89866659
2 438894	823497	716511	106985	89853958
3 439155	822902	715774	107128	89841157
4 439417	822307	715037	107270	89828356
5 439678	821712	714300	107412	89815555
6 439939	821118	713564	107555	89802854
7 440200	820525	712828	107697	89790053
8 440462	819932	712092	107840	89777152
9 440723	819339	711357	107982	89764351
10 440984	818747	710622	108125	89751550
11 441245	818155	709887	108268	89738749
12 441506	817564	709152	108411	89725848
13 441767	816973	708418	108555	89713047
14 442028	816382	707684	108698	89700146
15 442289	815792	706951	108841	89687345
16 442550	815203	706218	108985	89674444
17 442810	814613	705485	109128	89661543
18 443071	814025	704753	109272	89648642
19 443332	813436	704020	109416	89635741
20 443593	812848	703289	109560	89622840
21 443853	812261	702557	109704	89609939
22 444114	811674	701826	109848	89597038
23 444375	811087	701095	109992	89584137
24 444635	810501	700365	110136	89571236
25 444896	809915	699634	110281	89558235
26 445156	809330	698904	110425	89545334
27 445417	808745	698175	110570	89532333
28 445677	808160	697446	110714	89519432
29 445937	807576	696717	110860	89506431
30 446198	806993	695988	111005	89493430

Miz

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Deg. 26 + | —

<i>m.</i>	<i>Sines.</i>	<i>Logarit.</i>	<i>Differē.</i>	<i>Logarit.</i>	<i>Sines.</i>	
30	446198	806993	695988	111005	894934	30
31	446458	806409	695260	111150	894804	29
32	496718	805827	694532	111295	894675	28
33	446977	805244	693804	111440	894545	27
34	447238	804662	693076	111586	894415	26
35	447499	804081	692349	111731	894284	25
36	447759	803500	691623	111877	894154	24
37	448019	802919	690896	112022	894024	23
38	248279	802339	690170	112168	893894	22
39	448539	801759	689445	112314	893763	21
40	448799	801179	688719	112460	893633	20
41	449059	800600	687994	112607	893502	19
42	449319	800022	687269	112753	893372	18
43	449579	799444	686544	112899	893240	17
44	449839	798866	685820	113046	893110	16
45	450098	798289	685096	113192	892975	15
46	450358	797712	684373	113339	892848	14
47	450618	797135	683649	113486	892717	13
48	450878	796559	682926	113633	892586	12
49	451137	795983	682204	113780	892455	11
50	451397	795408	681482	113927	892323	10
51	451656	794833	680760	114074	892192	9
52	451916	794259	680038	114221	892061	8
53	452175	793685	679317	114368	891929	7
54	452435	793111	678595	114516	891798	6
55	452694	792538	677875	114664	891666	5
56	452953	791965	677154	114811	891534	4
57	453213	791393	676434	114959	891402	3
58	453472	790821	675714	115107	891270	2
59	453731	790250	674994	115255	891138	1
60	453990	789679	674275	115403	891006	0

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Deg. 27 +1—

mi	Sines.	Logarit.	Differen	Logarit.	Sines.
0	453990	789679	674275	115403	89100660
1	454250	789108	673556	115552	89087459
2	454509	788538	772837	115700	89074258
3	454768	787968	672119	115849	89061057
4	455027	787398	671401	115997	89047856
5	455286	786829	670683	116146	89034655
6	455545	786260	669966	116295	89021454
7	455804	785692	669249	116444	89008253
8	456063	785124	668532	116593	88995052
9	456322	784557	667815	116742	88981851
10	456580	783990	667099	116891	88968650
11	456839	783423	666383	117040	88955449
12	457098	782857	665668	117190	88942248
13	457357	782291	664952	117339	88929047
14	457615	781726	664237	117489	88915846
15	457874	781161	663522	117639	88902645
16	458132	780596	662808	117788	88889444
17	458391	780032	662094	117938	88876243
18	458650	779468	661380	118089	88863042
19	458908	778905	660666	118239	88849841
20	459166	778342	659953	118389	88836640
21	459425	777780	659240	118539	88823439
22	459683	777218	658528	118690	88810238
23	459942	776656	657815	118841	88797037
24	460200	776094	657103	118991	88783836
25	460458	775533	656391	119142	88770635
26	460716	774973	655680	119293	88757434
27	460974	774412	654968	119444	88744233
28	461232	773853	654257	119595	88731032
29	461491	773293	653547	119747	88717831
30	461749	772734	652836	119898	88704630

MW.

Deg. 62

Deg. 27

+ | -

	Sines.	Logarith.	Differen.	Logarit.	Sines	
30	461749	772734	652836	119898	887011	30
31	462007	772176	652126	120050	886877	29
32	462265	771617	651416	120201	886742	28
33	462522	771060	650707	120353	886608	27
34	462780	770502	649997	120505	886473	26
35	463038	769945	649289	120657	886338	25
36	463296	769389	648580	120809	886203	24
37	463554	768832	647872	120961	886069	23
38	463811	768277	647164	121113	885934	22
39	464069	767721	646456	121265	885799	21
40	464327	767166	645748	121418	885664	20
41	464584	766612	645041	121570	885529	19
42	464842	766057	644334	121723	885394	18
43	465099	765503	643628	121876	885258	17
44	465357	764950	642921	122029	885123	16
45	465614	764397	642215	122182	884988	15
46	465872	763844	641509	122335	884852	14
47	466129	763292	640804	122488	884716	13
48	466387	762740	640099	122641	884581	12
49	466644	762188	639394	122795	884445	11
50	466901	761637	638689	122948	884309	10
51	467158	761087	637985	123102	884174	9
52	467416	760536	637280	123255	884038	8
53	467673	759986	636577	123409	883902	7
54	467930	759437	635873	123563	883766	6
55	468187	758887	635170	123717	883629	5
56	468444	758339	634467	123871	883493	4
57	468701	757790	633764	124026	883357	3
58	468958	757242	633062	124180	883220	2
59	469215	756694	632360	124335	883084	1
60	469472	756147	631658	124489	882948	0

Min.

M

Deg. 62

Deg. 28 +

W.	Sines.	Logarith.	Differen.	Logarith.	Sines.
0	469472	756147	631658	124489	88294860
1	469728	755600	630956	124644	88281159
2	469985	755054	630255	124799	88267458
3	470242	754508	629553	124954	88253757
4	470499	653962	628853	125109	88240156
5	470755	753416	628152	125264	88226455
6	471012	752871	627452	125420	88212754
7	471268	752327	626752	125575	88199053
8	471525	751783	626052	125730	88185352
9	471781	751239	625353	125886	88171551
10	472038	750695	624654	126042	88157850
11	472294	750152	623955	126197	88144149
12	472551	749610	623256	126353	88130348
13	472807	749067	622558	126509	88116647
14	473063	748525	621860	126665	88102846
15	473320	747984	621162	126822	88089145
16	473576	747443	620465	126978	88075344
17	473832	746902	619768	127134	88061543
18	474088	746362	619071	127291	88047742
19	474344	745822	618374	127448	88033941
20	474600	745282	617677	127604	88020140
21	474856	744743	616981	127761	88006339
22	475112	744204	616285	127918	87992538
23	475368	743665	615590	128075	87978737
24	475624	743127	614894	128233	87964936
25	475880	742589	614199	128390	87951135
26	476136	742052	613506	128547	87937334
27	476392	741515	612810	128705	87923533
28	476647	740978	612115	128863	87909732
29	476907	740442	611421	129020	87895931
30	477159	739906	610727	129178	87882130

Min.

Deg. 61

Deg. 28

+ | -

	Sines.	Logarith.	Differen	Logarit.	Sines	
30	477159	739906	610727	129178	878817	30
31	477414	739370	610034	129336	878678	29
32	477670	738835	609340	129494	878539	28
33	477925	738300	608647	129653	878400	27
34	478181	737766	607955	129811	878261	26
35	478436	737232	607262	129969	878122	25
36	478692	736698	606570	130128	877983	24
37	478947	736165	605878	130286	877844	23
38	479203	735632	605186	130445	877704	22
39	479458	735099	604495	130604	877565	21
40	479713	734567	603804	130763	877425	20
41	479968	734035	603113	130922	877286	19
42	480224	733503	602422	131081	877146	18
43	480479	732972	601731	131241	877006	17
44	480734	732441	601041	131400	876867	16
45	480989	731911	600351	131560	876727	15
46	481244	731381	599662	131719	876587	14
47	481499	730851	598972	131879	876447	13
48	481754	730322	598283	132039	876307	12
49	482009	729793	597594	132199	876166	11
50	482263	729264	596906	132359	876026	10
51	482518	728736	596217	132519	875886	9
52	482773	728208	595529	132680	875746	8
53	483028	727681	594841	132840	875605	7
54	483282	727154	594153	133000	875465	6
55	483537	726627	593466	133161	875324	5
56	483792	726101	592779	133322	875183	4
57	484046	725575	592092	133483	875042	3
58	484301	725049	591405	133644	874902	2
59	484555	724524	590719	133805	874761	1
60	484810	723999	590033	133966	874620	0

Min.

H 2

Deg. 61

Deg. 29

+1-

m.	Sines	Logarith	Differen.	Logarith	Sines	
0	484810	723999	590033	133966	874620	60
1	485064	723474	589347	134127	874479	59
2	485318	722950	588661	134289	874338	58
3	485573	722426	587976	134450	874196	57
4	485827	921903	587291	134612	874055	56
5	486081	721379	586606	134774	873914	55
6	486335	720857	585921	134935	873772	54
7	486589	720334	585237	135097	873631	53
8	486844	719812	584553	135259	873489	52
9	487098	719290	583869	135422	873347	51
10	487352	718769	583185	135584	873206	50
11	487606	718248	582501	135746	873064	49
12	487860	717727	581818	135909	872922	48
13	488113	717207	581135	136071	872780	47
14	488367	716687	580453	136234	872638	46
15	488621	716167	579770	136397	872496	45
16	488875	715648	579088	136560	872354	44
17	489129	715129	578406	136723	872212	43
18	489382	714611	577724	136886	872069	42
19	489636	714092	577043	137050	871927	41
20	489890	713575	576361	137213	871784	40
21	490143	713057	575681	137377	871642	39
22	490397	712540	575000	137540	871499	38
23	490650	712023	574319	137704	871356	37
24	490904	711507	573639	137868	871214	36
25	491157	710991	572959	138032	871071	35
26	491410	710475	572279	138196	870928	34
27	491664	709960	571600	138360	870785	33
28	491917	709445	570920	138524	870642	32
29	492170	708930	570241	138689	870499	31
30	492423	708416	569562	138853	870356	30

Min.

Deg. 60

Deg. 29 +

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
30	492423	708416	569562	138853	870356 30
31	492677	707902	568884	139018	870212 29
32	492930	707388	568206	139183	870069 28
33	493183	706875	567527	139347	869926 27
34	493436	706362	566850	139512	869782 26
35	493689	705849	566172	139677	869639 25
36	493942	705337	565494	139843	869495 24
37	494195	704825	564817	140008	869351 23
38	494448	704314	564140	140173	869207 22
39	494700	703803	563464	140339	869064 21
40	494953	703292	562787	140504	868920 20
41	495206	702781	562111	140670	868776 19
42	495459	702271	561435	140836	868632 18
43	495711	701761	560759	141002	868487 17
44	495965	701252	560084	141168	868343 16
45	496216	700743	559408	141334	868199 15
46	496469	700234	558733	141500	868054 14
47	496721	699726	558059	141667	867910 13
48	496974	699218	557384	141834	867765 12
49	497226	698710	556709	142000	867620 11
50	497479	698202	556035	142167	867476 10
51	497731	697695	555361	142334	867331 9
52	497983	697189	554687	142501	867187 8
53	498236	696682	554014	142668	867042 7
54	498488	696176	553345	142835	866897 6
55	498740	695670	552668	143003	866752 5
56	498992	695165	551995	143170	866607 4
57	499244	694660	551322	143338	866461 3
58	499496	694155	550650	143505	866316 2
59	499748	693651	549978	143673	866171 1
60	500000	693147	549306	143841	866025 0

Min.

H 3

Deg. 60

Deg. 30

—+—

m.	Sines	Logarith.	Differen.	Logarith.	Sines
0	500000	693147	549306	143841	866025
1	500252	692643	548634	144009	865880
2	500504	692140	547963	144177	865734
3	500756	691637	547292	144345	865589
4	501007	691134	546621	144514	865443
5	501259	690632	545950	144682	865297
6	501510	690130	545279	144851	865151
7	501762	689628	544609	145019	865005
8	502014	689127	543939	145188	864859
9	502266	688626	543269	145357	864713
10	502517	688125	542599	145526	864567
11	502769	687625	541930	145695	864421
12	503020	687125	541260	145864	864275
13	503271	686625	540591	146034	864128
14	503523	686126	539923	146203	863982
15	503774	685627	539254	146373	863835
16	504025	685128	538586	146543	863689
17	504276	684630	537918	146712	863542
18	504528	684132	537250	146882	863396
19	504779	683635	536582	147052	863249
20	505030	683137	535915	147223	863102
21	505281	682640	535247	147393	862955
22	505532	682144	534580	147563	862808
23	505783	681648	533914	147734	862661
24	506034	681152	533247	147904	862514
25	506285	680656	532581	148075	862366
26	506535	680161	431915	148246	862219
27	506786	679666	531249	148417	862072
28	507037	679171	530583	148588	861924
29	507288	678677	529918	148759	861777
30	507538	678183	529252	148930	861629

Min.

Deg. 59

Deg. 30

+1-

m.	Sines	Logarith.	Differen.	Logarith.	Sines
30	507538	678183	529252	148930	861629
31	507789	677689	528587	149102	861481
32	508040	677196	527922	149273	861334
33	508290	676703	527258	149445	861186
34	508541	676210	526593	149616	861038
35	508791	675717	525929	149788	860890
36	509041	675225	525265	149960	860742
37	509292	674734	524601	150132	860594
38	509542	674242	523938	150305	860446
39	509792	673751	523274	150477	860297
40	510043	673261	522611	150649	860149
41	510293	672770	521948	150822	860001
42	510543	672280	521285	150995	859852
43	510793	671790	520623	151167	859704
44	511043	671301	519961	151340	859555
45	511293	670812	519299	151513	859406
46	511543	670323	518637	151686	859258
47	511793	669835	517975	151860	859109
48	512043	669347	517314	152033	858960
49	512293	668859	516652	152206	858811
50	512542	668371	515991	152380	858662
51	512792	667884	515330	152554	858513
52	513042	667397	514670	152727	858363
53	513292	666911	514009	152901	858214
54	513541	666425	513349	153075	858065
55	513791	665939	512689	153250	857915
56	514040	665453	512029	153424	857766
57	514290	664968	511370	153598	857616
58	514539	664483	510710	153773	857467
59	514789	663998	510051	153947	857317
60	515038	663514	509392	154122	857167

M.m.

H 4

Deg. 59

Deg. 31

+1-2

m.	Sines	Logarith.	Differen	Logarit.	Sines
0	515038	663514	5093 92	154122	857167 60
1	515287	663030	508733	154297	857017 59
2	515537	662546	508074	154472	856868 58
3	515786	662063	507416	154647	856718 57
4	516035	661580	506758	154822	856567 56
5	516284	661097	506100	154998	856417 55
6	516533	660615	505442	155173	856267 54
7	516782	660133	504784	155348	856117 43
8	517031	659651	504127	155524	855966 52
9	517280	659170	503470	155700	855816 51
10	517529	658689	502813	155875	855665 50
11	517778	658208	502156	156052	855515 49
12	518027	657727	501500	156228	855364 48
13	518276	657247	500843	156404	855214 47
14	518525	656768	500187	156580	855063 46
15	518773	656288	499531	156757	854912 45
16	519022	655809	498875	156933	854761 44
17	519271	655330	498220	157110	854610 43
18	519519	654851	497564	157287	854459 42
19	519767	654373	496909	157464	854308 41
20	520016	653895	496254	157641	854156 40
21	520265	653417	495599	157818	854005 39
22	520513	652940	494945	157995	853854 38
23	520761	652463	494290	158172	853702 37
24	521010	651986	493636	158350	853551 36
25	521258	651510	492982	158528	853399 35
26	521506	651034	492328	158705	853248 34
27	521754	650558	491675	158883	853096 33
28	522002	650083	491021	159061	852944 32
29	522251	649607	490368	159239	852792 31
30	522499	649133	489715	159418	852640 30

Min.

Deg. 58

Deg. 31

m	Sines.	Logarith.	Differen.	Logarit.	Sines.
30	522499	649133	489715	159418	852640
31	522747	648658	489062	159596	852488
32	522995	648184	488410	159774	852336
33	523242	647710	487757	159953	852184
34	523490	647237	487105	160132	852032
35	523738	646763	486453	160310	851879
36	523980	646290	485801	160489	851727
37	524234	645818	485149	160668	851574
38	524481	645345	484493	160847	851422
39	524729	644873	483846	161027	851269
40	524977	644401	483195	161206	851117
41	525224	643930	482544	161385	850964
42	525472	643459	481894	161565	850811
43	525719	642988	481243	161745	850658
44	525966	642517	480593	161925	850505
45	526214	642047	479943	162105	850352
46	526461	641577	479293	162285	850199
47	526708	641108	478643	162465	850046
48	526956	640638	477993	162645	849893
49	527203	640169	477344	162826	849739
50	527450	639701	476695	163006	849586
51	527697	639232	476046	163187	849433
52	527944	638764	475397	163368	849279
53	528191	638296	474748	163548	849125
54	528438	637829	474099	163729	848972
55	528685	637362	473451	163911	848818
56	528932	636895	472803	164092	848664
57	529179	636428	472155	164273	848510
58	529426	635962	471507	164455	848356
59	529672	635496	470860	164636	848202
60	529919	635030	470213	164818	848048

Min.

H 5

Deg. 58

Deg. 32 +1—

W.	Sines	Logarith.	Differen.	Logarit.	Sines.
0	529919	635030	470213	164818	848048 60
1	530166	634565	469565	165000	847894 59
2	530412	634100	468919	165182	847730 58
3	530659	633635	468272	165364	847585 57
4	530906	633171	467624	165546	847431 56
5	531152	632706	466978	165728	847276 55
6	531398	632243	466332	165911	847122 54
7	531645	631779	465686	166093	846967 53
8	531891	631316	465040	166276	846813 52
9	532138	630853	464394	166458	846658 51
10	532384	630390	463749	166641	846503 50
11	532630	629928	463103	166824	846348 49
12	532876	629466	462458	167007	846193 48
13	533122	629004	461813	167191	846038 47
14	533368	628542	461168	167374	845883 46
15	533614	628081	460523	167558	845728 45
16	533860	627620	459879	167741	845572 44
17	534106	627160	459235	167925	845417 43
18	534352	626700	458590	168109	845262 42
19	534598	626239	457947	168293	845106 41
20	534844	625780	457303	168477	844951 40
21	535090	625320	456659	168661	844795 39
22	535335	624861	456016	168845	844640 38
23	535581	624402	455373	169030	844484 37
24	535827	623944	454730	169214	844328 36
25	536072	623486	454086	169399	844172 35
26	536318	623028	453444	169584	844016 34
27	536563	622570	452802	169768	843860 33
28	536809	622113	452159	169953	843704 32
29	537054	621656	451517	170139	843548 31
30	537300	621199	450875	170324	843391 30

2117.

Deg. 57

Deg. 32

+1—

m	Sines	Logarith.	Differen.	Logarit.	Sines
30	537300	621199	450875	170324	843391
31	537545	620743	450233	170509	843235
32	537790	620286	449592	170695	843079
33	538035	619831	448950	170880	842922
34	538281	619375	448309	171066	842766
35	538526	618920	447668	171252	842609
36	538771	618465	447027	171438	842452
37	539016	618010	446386	171624	842296
38	539261	617556	445745	171810	842139
39	539506	617101	445105	171997	841982
40	539751	616648	444465	172183	841825
41	539985	616194	443824	172370	841666
42	540240	615741	443184	172556	841511
43	540485	615288	442545	172743	841354
44	540730	614835	441905	172930	841196
45	540974	614383	441266	173117	841039
46	541219	613931	440626	173304	840882
47	541464	613479	439988	173492	840724
48	541708	613027	439348	173679	840567
49	541953	612576	438710	173867	840409
50	542197	612125	438071	174054	840251
51	542442	611675	437433	174242	840093
52	542686	611224	436794	174430	839936
53	542930	610774	436156	174618	839778
54	543174	610325	435519	174806	839620
55	543419	609875	434881	174994	839462
56	543663	609426	434243	175183	839304
57	543907	608977	433606	175371	839146
58	544151	608528	432969	175560	838987
59	544395	608080	432332	175748	838829
60	544639	607632	431695	175937	838671

Min.

Deg. 57

Deg. 33



m.	Sines	Logarith.	Differen	Logarit.	Sines
0	544639	607632	431695	75937	838671
1	544883	607184	431058	76126	838512
2	545127	606737	430421	76315	838354
3	545371	606289	429785	76504	838195
4	545614	605842	429149	76694	838036
5	545858	605396	428513	76883	837878
6	546102	604949	427877	77073	837719
7	546346	604503	427241	77262	837560
8	546580	604057	426605	77452	837401
9	546833	603612	425970	77642	837242
10	547076	603167	425335	77832	837083
11	547320	602722	424699	78022	836924
12	547563	602277	424064	78213	836764
13	547807	601833	423430	78403	836605
14	548050	601389	422795	78594	836446
15	548293	600945	422160	78784	836286
16	548536	600501	421526	78975	836127
17	548780	600058	420892	79166	835967
18	549023	599615	420258	79357	835807
19	549266	599172	419624	79548	835648
20	549509	598730	418990	79739	835488
21	549752	598288	418357	79931	835328
22	549995	597846	417724	80122	835168
23	550238	597404	417090	80314	835008
24	550481	596963	416457	80506	834848
25	550724	596522	415824	80698	834688
26	550966	596081	415192	80890	834527
27	551209	595641	414559	81082	834367
28	551452	595201	413927	81274	834207
29	551694	594761	413294	81466	834046
30	551937	594321	412662	81659	833886

Min.

Deg. 56

Deg. 33 +

mi	Sines	Logarit.	Differē.	Logarit.	Sines	
30	551937	594321	412662	181659	833886	30
31	552179	594883	412031	181851	833725	29
32	552422	593444	411400	182044	833565	28
33	552664	593005	410768	182237	833404	27
34	552907	592566	410137	182430	833243	26
35	553149	592127	409504	182623	833082	25
36	553392	591689	408873	182816	832921	24
37	553634	591252	408242	183009	832760	23
38	553876	590814	407611	183203	832599	22
39	554118	590377	406980	183396	832438	21
40	554360	589940	406350	183590	832277	20
41	554602	589504	405720	183784	832115	19
42	554844	589067	405089	183978	831954	18
43	555086	588631	404459	184172	831793	17
44	555328	588195	403829	184366	831631	16
45	555570	587760	403200	184560	831470	15
46	555812	587325	402570	184755	831308	14
47	556054	586890	401940	184949	831146	13
48	556296	586455	401311	185144	830984	12
49	556537	586021	400682	185339	830823	11
50	556779	585587	400053	185534	830661	10
51	557021	585153	399424	185729	830499	9
52	557262	584719	398795	185924	830337	8
53	557504	584286	398167	186119	830175	7
54	557745	583853	397538	186315	830012	6
55	557987	583420	396910	186510	829850	5
56	558228	582988	396282	186706	829688	4
57	558469	582556	395654	186902	829525	3
58	558711	582123	395026	187098	829363	2
59	558952	581692	394398	187294	829200	1
60	559193	581261	393771	187490	829038	0

Min.

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m	Sines	Logarit	Differ	Logarit	Sines
0	559193	581261	393771	187490	829038 60
1	559434	580829	393143	187686	828879 59
2	559675	580399	392516	187882	828712 58
3	559916	579968	391889	188079	828549 57
4	560157	579538	391262	188275	828386 56
5	560398	579108	390635	188472	828222 55
6	560639	578678	390009	188669	828060 54
7	560880	578248	389382	188866	827897 53
8	561121	577819	388756	189063	827734 52
9	561361	577390	388130	189260	827571 51
10	561602	576961	387504	189458	827407 50
11	561843	576533	386878	189655	827244 49
12	562083	576105	386252	189853	827081 48
13	562324	575677	385626	190051	826917 47
14	562564	575249	385001	190249	826753 46
15	562805	574822	384375	190447	826590 45
16	563025	574395	383750	190645	826426 44
17	563286	573968	383125	190843	826262 43
18	563516	573541	382500	191041	826098 42
19	563766	573115	381875	191240	825934 41
20	564007	572689	381250	191439	825770 40
21	564247	572263	380626	191637	825606 39
22	564487	571838	380002	191836	825442 38
23	564727	571413	379377	192035	825278 37
24	564967	570988	378754	192234	825114 36
25	565207	570563	378130	192433	824949 35
26	565447	570139	377506	192633	824785 34
27	565687	569714	376882	192832	824620 33
28	565927	569291	376259	193032	824456 32
29	566166	568867	375635	193232	824291 31
30	566406	568444	375012	193431	824126 30

Min.

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Deg. 34

m.	Sines	Logarit.	Differē.	Logarit.	Sines.	
30	566406	568444	375012	193414	824126	30
31	566646	568920	374389	193631	823961	29
32	566886	567598	373766	193831	823796	28
33	567126	567175	373143	194032	823632	27
34	567365	566753	372521	194232	823467	26
35	567604	566331	371898	194433	823301	25
36	567844	565909	371276	194633	823136	24
37	568083	565487	370653	194834	822971	23
38	568323	565066	370031	195035	822806	22
39	568562	564645	369409	195236	822640	21
40	568801	564224	368787	195437	822475	20
41	569040	563804	368165	195638	822310	19
42	569280	563383	367544	195840	822144	18
43	569519	562963	366922	196041	821978	17
44	569758	562544	366301	196243	821813	16
45	569997	562124	365680	196444	821647	15
46	570236	561705	365059	196646	821481	14
47	570475	561286	364438	196848	821315	13
48	570714	560868	363817	197051	821149	12
49	570952	560449	363196	197253	820983	11
50	571191	560031	362576	197455	820817	10
51	571429	559613	361956	197657	820651	9
52	571669	559196	361335	197860	820485	8
53	571907	558778	360715	198063	820318	7
54	572146	558361	360095	198266	820152	6
55	572384	557944	359476	198469	819985	5
56	572623	557528	358856	198672	819819	4
57	572861	557111	358236	198875	819652	3
58	573100	556695	357617	199078	819485	2
59	573338	556279	356998	199282	819319	1
60	573576	555864	356378	199485	819152	0

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m.	Sines	Logarit	Differē.	Logarit.	Sines.
0	573576	555864	356378	199485	819152 60
1	573815	555449	355759	199689	818985 59
2	574053	555034	355140	199863	818818 58
3	574291	554619	354522	200097	818651 57
4	574529	554204	353903	200301	818484 56
5	574767	553790	353185	200505	818317 55
6	575005	553376	352666	200710	818150 54
7	575243	552962	352048	200914	817982 53
8	575481	552549	351430	201119	817815 52
9	575719	552135	350812	201324	817648 51
10	575957	551722	350194	201528	817480 50
11	576195	551310	349576	201733	817313 49
12	576432	550897	348958	201939	817145 48
13	576670	550485	348341	202144	816977 47
14	576908	550073	347724	202349	816809 46
15	577145	549661	347106	202555	816642 45
16	577383	549250	346489	202760	816474 44
17	577620	548838	345872	202966	816306 43
18	577858	548427	345255	203172	816138 42
19	578095	548017	344639	203378	815969 41
20	578332	547606	344022	203584	815801 40
21	578570	547196	343405	203791	815633 39
22	578807	546786	342789	203997	815465 38
23	579044	546376	342173	204204	815296 37
24	579281	545967	341557	204410	815128 36
25	579518	545558	340941	204617	814959 35
26	579755	545148	340325	204824	814791 34
27	579992	544740	339709	205031	814622 33
28	580229	544332	339093	205238	814453 32
29	580466	543923	338478	205446	814284 31
30	580703	543516	337863	205653	814115 30

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Deg. 35 +1—

ms.	Sines	Logarit.	Differē.	Logarit.	'Sines.	
30	580703	543516	337863	205653	814115	30
31	580940	543108	337247	205861	913946	29
32	581177	542700	336642	206068	813777	28
33	581413	542293	336017	206276	813608	27
34	581650	541886	335402	206484	813439	26
35	581886	541480	334788	206692	813270	25
36	582123	541073	334173	206900	813101	24
37	582359	540667	333559	207108	812931	23
38	582596	540261	332944	207317	812762	22
39	582832	539855	332330	207525	812592	21
40	583069	539450	331716	207734	812423	20
41	583305	539045	331102	207943	812253	19
42	583541	538640	330488	208152	812083	18
43	583777	538235	329874	208361	811914	17
44	584014	537831	329260	208570	811744	16
45	584250	537427	328647	208780	811574	15
46	584486	537023	328033	208989	811404	14
47	584722	536619	327420	209199	811234	13
48	584958	536215	326807	209408	811064	12
49	585194	535812	326193	209618	810894	11
50	585429	535409	325581	209828	810723	10
51	585665	535007	324968	210038	810553	9
52	585901	534604	324356	210249	810483	8
53	586137	534202	323743	210459	810212	7
54	586372	533800	323131	210669	810042	6
55	586608	533398	322518	210880	809871	5
56	586844	532997	321906	211091	809700	4
57	587079	532596	321294	211302	809530	3
58	587314	532195	320682	211513	809359	2
59	587550	531794	320070	211724	809188	1
60	587785	531393	319458	211935	809017	0

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m.	Sines.	Logarit	Differē	Logarit.	Sines	
0	587785	531393	319458	211935	808017	60
1	588020	530993	318846	212147	808946	59
2	588256	530593	318235	212358	808675	58
3	588491	530193	317624	212570	808504	57
4	588726	529794	317012	212782	808333	56
5	588961	529395	316401	212994	808161	55
6	589196	528996	315790	213206	807990	54
7	589431	528597	315179	213418	807818	53
8	589666	528198	314568	213630	807647	52
9	589901	527800	313957	213843	807475	51
10	590136	527402	313347	214055	807304	50
11	590371	527004	312736	214268	807132	49
12	590606	526607	312126	214481	806960	48
13	590840	526209	311515	214694	806788	37
14	591075	525812	310905	214907	806617	46
15	591310	525415	310295	215120	806445	45
16	591544	525019	309685	215333	806273	44
17	591779	524622	309075	215547	806100	43
18	592013	524226	308466	215760	805928	42
19	592248	523830	307856	215974	805756	41
20	592482	523434	307247	216188	805584	40
21	592716	523039	306637	216402	805412	39
22	592950	522644	306028	216611	805239	38
23	593185	522249	305419	216830	805066	37
24	593419	521854	304810	217045	804894	36
25	593653	521460	304201	217259	804721	35
26	593887	521066	303592	217474	804548	34
27	594121	520672	302983	217689	804376	33
28	594355	520278	302375	217904	804203	32
29	594589	519885	301766	218119	804030	31
30	594823	519491	301158	218334	803857	30

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Deg. 36 +1-

m	Sines.	Logarit.	Differē.	Logarit.	Sines.
30	594823	519492	301158	218334	803857
31	595057	519099	300549	218549	803684
32	595290	518706	299941	218765	803511
33	595524	518313	299333	218980	803337
34	595758	517921	298725	219196	803164
35	595991	517529	298117	219412	802991
36	596225	517137	297509	219628	802817
37	596458	516746	296902	219844	802644
38	596692	516354	296294	220060	802470
39	596925	515963	295687	220276	802297
40	597150	515572	295079	220493	802123
41	597392	515182	294472	220710	801949
42	597625	514791	293865	220926	801776
43	597858	514401	293258	221143	801602
44	598091	514011	292651	221360	801428
45	598325	313622	292044	221577	801254
46	598558	513232	291437	221795	801080
47	598791	512843	290831	222012	800906
48	599024	512454	290224	222230	800731
49	599257	512065	289618	222447	800557
50	599489	511677	289012	222665	800383
51	599722	511289	288406	222883	800208
52	599955	510901	287799	223101	800034
53	600188	510513	287193	223319	799859
54	600420	510125	286588	223538	799685
55	600653	509738	285982	223756	799510
56	600885	509351	285376	223975	799335
57	601118	508964	284771	224193	799160
58	601350	508577	284165	224412	798985
59	601583	508191	283560	224631	798810
60	601815	507805	282954	224851	798635

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Deg. 37 +11

m.	Sines.	Logarit.	Differen	Logarit.	Sines.
0	601815	507805	282954	224851	798635
1	602047	507419	282349	225070	798460
2	602280	507033	281744	225289	798285
3	602512	506648	281139	225509	798110
4	602744	506263	280534	225728	797935
5	602976	505878	279929	225948	797759
6	603208	505493	279325	226168	797584
7	603440	505108	278720	226388	797408
8	603672	504724	278116	226608	797233
9	603904	504340	277521	226829	797057
10	604136	503956	276907	227049	796881
11	604367	503573	276303	227270	796706
12	604599	503189	275699	227490	796530
13	604831	502806	275095	227711	796354
14	605062	502423	274491	227932	796178
15	605294	502041	273887	228153	796002
16	605525	501658	273284	228375	795826
17	605757	501276	272680	228596	795650
18	605988	500894	272076	228818	795473
19	606220	500512	271473	229039	795297
20	606451	500131	270870	229261	795121
21	606682	499750	270266	229483	794944
22	606914	499369	269663	229705	794768
23	607145	498988	269060	229928	794591
24	607376	498607	268457	230150	794415
25	607607	498227	267854	230372	794238
26	607838	497847	267252	230595	794061
27	608069	497467	266649	230818	793884
28	608300	497087	266047	231041	793707
29	608531	496708	265444	231263	793530
30	608761	496329	264842	231487	793353

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Deg. 52

Deg. 37 $\frac{1}{2}$

m.	Sines.	Logarit.	Differen	Logarit.	Sines	
30	608761	496329	264842	131487	793353	30
31	608992	495950	264240	131710	793176	29
32	609223	495571	263638	131933	792999	28
33	609454	495192	263036	132157	792822	27
34	609684	494814	262434	132380	792644	26
35	609915	494436	261833	132604	792467	25
36	610145	494058	261230	132828	792290	24
37	610376	493681	260628	133052	792112	23
38	610606	493303	260027	133276	791934	22
39	610836	492926	259425	133501	791757	21
40	611067	492549	258824	133725	791579	20
41	611297	492172	258222	133950	791401	19
42	611527	491796	257621	134175	791223	18
43	611757	491419	257020	134400	791046	17
44	611987	491043	256419	134625	790868	16
45	612217	490668	255818	134850	790690	15
46	612447	490292	255217	135075	790511	14
47	612677	489917	254616	135300	790333	13
48	612907	489542	254016	135526	790155	12
49	613137	489167	253415	135752	789977	11
50	613367	488792	252814	135978	789798	10
51	613596	488418	252214	136204	789620	9
52	613826	488043	251614	136430	789441	8
53	614056	487669	251014	136656	789263	7
54	614285	487296	250413	136882	789084	6
55	614515	486922	249813	137109	788905	5
56	614744	486549	249213	137335	788727	4
57	614975	486176	248614	137562	788548	3
58	615203	485803	248014	137789	788369	2
59	615432	485430	247414	138016	788190	1
60	615661	485058	246814	138243	788011	0

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Deg. 38 +1—

mi.	Sines.	Logarit.	Differē.	Logarit.	Sines.
0	615661	485058	246814	238243	788011 60
1	615891	484686	246215	238471	787832 59
2	616120	484314	245615	238699	787652 58
3	616349	483942	245016	238926	787473 57
4	616578	483570	244417	239153	787294 56
5	616807	483199	243817	239381	787114 55
6	617026	482828	243218	239609	786935 54
7	617265	482457	242619	239838	786755 53
8	617494	482086	242020	240066	786576 52
9	617722	481716	241421	240294	786396 51
10	617951	481346	240823	240523	786217 50
11	618180	480976	240224	240751	786037 49
12	618408	480606	239625	240980	785857 48
13	618637	480236	239027	241209	785677 47
14	618866	479867	238428	241438	785497 46
15	619094	479498	237830	241668	785317 55
16	619322	479129	237232	241897	785137 44
17	619551	478760	236633	242127	784957 43
18	619779	478392	236035	242356	784776 42
19	620007	478024	235437	242586	784596 41
20	620236	477656	234840	242816	784416 40
21	620464	477288	234242	243046	784235 39
22	620692	476920	233644	243276	784055 38
23	620920	476553	233046	243507	783874 37
24	621148	476186	232449	243737	783693 36
25	621376	475819	231851	243968	783513 35
26	621604	475452	231254	244199	783332 34
27	621831	47508	230656	244429	783151 33
28	622059	474720	230059	244660	782970 32
29	622287	474354	229462	244892	782789 31
30	622515	473988	228865	245123	782608 30

Min.

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Deg. 38 +1-

m.	Sines.	Logarit	Differe	Logarit.	Sines.
30	622515	473988	228865	245123	782608
31	622742	473622	228268	245354	782427
32	622970	473257	227671	245586	782246
33	623197	472892	227074	245818	782065
34	623425	472527	226477	246050	781883
35	623652	472164	225880	246282	781702
36	623880	471798	225284	246514	781520
37	624107	471434	224688	246746	781339
38	624334	471069	224091	246978	781157
39	624561	470706	223495	247211	780976
40	624788	470341	222898	247444	780794
41	625016	469978	222302	247676	780612
42	625243	469615	221706	247909	780430
43	625469	469252	221110	248143	780248
44	625697	468889	220514	248376	780066
45	625923	468527	219918	248609	779884
46	626150	468164	219322	248843	779702
47	626377	467802	218726	249076	779520
48	626604	467440	218130	249310	779338
49	626830	467079	217534	249544	779156
50	627057	466717	216939	249778	778973
51	627284	466356	216343	250013	778791
52	627510	465995	215748	250247	778608
53	627737	465634	215153	250481	778426
54	627963	465274	214557	250716	778243
55	628189	464913	213962	250951	778060
56	628416	464553	213367	251186	777878
57	628642	464193	212772	251421	777695
58	628868	463833	212177	251656	777512
59	629094	463474	211582	251891	777329
60	629320	463115	210988	252127	777146

min.

Deg. 39

Deg. 39 +1—

m.	Sines.	Logarit.	Different	Logarit.	Sines.
0	629320	463115	210988	252127	77714660
1	629546	462755	210393	252363	77696359
2	629772	462397	109798	252598	77678058
3	629998	462038	209204	252834	77659657
4	630224	461679	208609	253070	77641356
5	630450	461321	208015	253306	77623055
6	630676	460963	207420	253543	77604654
7	630902	460605	206826	253779	77586353
8	631127	460248	206232	254016	77567952
9	631353	459890	205638	254253	77549651
10	631578	459533	205043	254489	77531250
11	631804	459176	204449	254726	77512849
12	632029	458819	203855	254964	77494448
13	632255	458463	203261	255201	77476147
14	632480	458106	202668	255438	77457746
15	632705	457750	202074	255676	77439345
16	632930	457394	201481	255914	77420844
17	633156	457039	200887	256152	77402443
18	633381	456683	200293	256390	77384042
19	633606	456328	199700	256628	77365641
20	633831	455973	199107	256866	77347240
21	634056	455618	198513	257105	77328739
22	634281	455263	197920	257343	77310338
23	634506	454909	197327	257582	77291837
24	634731	454555	196734	257821	77273436
25	634955	454201	196141	258060	77254935
26	635180	453847	195548	258299	77236434
27	635405	453493	194955	258538	77217933
28	635629	453140	194362	258778	77199432
29	635854	452787	193769	259017	77181031
30	636078	452434	193177	259257	77162530

Min.

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Deg. 39

m.	Sines.	Logarit.	Differē.	Logarit.	Sines
30	636078	452434	193177	259257	77162550
31	636303	452081	192584	259497	77143929
32	636527	451728	191991	259737	77125428
33	636751	451376	191399	259977	77106927
34	636976	451024	190806	260217	77088426
35	637200	450672	190214	260458	77069925
36	637424	450320	189622	260698	77051324
37	637648	449968	189029	260939	77032823
38	637872	449617	188437	261180	77014222
39	638096	449266	187845	261421	76995721
40	638320	448915	187253	261662	76977120
41	638544	448564	186661	261903	76958519
42	638768	448214	186069	262145	76939918
43	638992	447864	185477	262386	76921417
44	639215	447514	184885	262628	76902816
45	639439	447164	184294	262870	76884215
46	639663	446814	183702	263112	76865514
47	639886	446465	183110	263354	76846913
48	640110	446115	182519	263596	76828312
49	640333	445766	181928	263838	76809711
50	640557	445418	181336	264081	76791110
51	640780	445069	180745	264324	7677259
52	641003	444721	180154	264567	7675388
53	641226	444372	179562	264810	7673527
54	641450	444024	178971	265053	7671656
55	641673	443677	178380	265296	7669795
56	641896	443329	177789	265540	7667924
57	642119	442982	177198	265783	7666053
58	642342	442634	176607	266027	7664182
59	642565	442287	176017	266271	7662311
60	642778	441941	175426	266515	7660440

M. n.

I Deg. 50

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+|-

m	Sines.	Logarith.	Differen	Logarit.	Sines	
c	642788	441941	175426	266515	766044	60
1	643010	441594	174835	266759	765857	59
2	643233	441248	174245	267003	765670	58
3	643456	440902	173654	267248	765483	57
4	643678	440556	173064	267492	765296	56
5	643901	440210	172473	267737	765109	55
6	644124	439865	171883	267982	764921	54
7	644346	439519	171293	268227	764734	53
8	644568	439174	170702	268472	764547	52
9	644791	438829	170112	268717	764359	51
10	645013	438484	169522	268963	764171	50
11	645235	438140	168931	269208	763984	49
12	645458	437795	168341	269454	763796	48
13	645680	437451	167751	269700	763608	47
14	645902	437107	167161	269946	763420	46
15	646124	436764	166571	270192	763232	45
16	646346	436420	165982	270439	763044	44
17	646568	436077	165392	270685	762856	43
18	646790	435734	164802	270932	762668	42
19	647012	435391	164212	271179	762480	41
20	647233	435048	163623	271425	762292	40
21	647455	434706	163033	271673	762104	39
22	647677	434363	162444	271920	791915	38
23	647898	434021	161854	272167	761727	37
24	648120	433679	161265	272415	761538	36
25	648341	433338	160675	272662	761350	35
26	648563	432996	160086	272910	761161	34
27	648784	432655	159497	273158	760972	33
28	649005	432314	158908	273406	760784	32
29	649227	431973	158319	273654	760595	31
30	649448	431632	157730	273903	760406	30

Min.

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Deg. 40 + —

Min.	Sines	Logarith.	Differen.	Logarit.	Sines	Min.
30	649448	431632	157730	273903	760406	30
31	649669	431292	157141	274151	760217	29
32	649890	430952	156552	274400	760028	28
33	650111	430612	155963	274649	759839	27
34	650332	430272	155374	274898	759650	26
35	650553	429932	154785	275147	759461	25
36	650774	429592	154196	275396	759271	24
37	650995	429253	153608	275645	759082	23
38	651216	428914	153019	275895	758892	22
39	651436	428575	152430	276145	758703	21
40	651657	428236	151842	276394	758514	20
41	651878	427898	151253	276644	758324	19
42	652098	427560	150665	276895	758134	18
43	652319	427222	150077	277145	757945	17
44	652539	426884	149488	277395	757755	16
45	652760	426546	148900	277646	757565	15
46	652980	426208	148312	277897	757375	14
47	653200	425871	147724	278147	757185	13
48	653421	425534	147136	278398	756995	12
49	653641	425197	146548	278650	756805	11
50	653861	424860	145960	278901	756615	10
51	654081	424524	145372	279152	756425	9
52	654301	424188	144784	279404	756234	8
53	654521	423852	144196	279656	756044	7
54	654741	423516	143608	279907	755853	6
55	654961	423180	143020	280159	755663	5
56	655180	422844	142433	280412	755472	4
57	655400	422509	141845	280664	755282	3
58	655620	422174	141257	280917	755091	2
59	655839	421839	140670	281169	754900	1
60	656059	421504	140082	281422	754710	0

Min.

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<i>Sines</i>	<i>Logarit.</i>	<i>Differē.</i>	<i>Logarit.</i>	<i>Sines</i>
0 656059	421504	140082	281422	754710 50
1 656278	421170	139495	281675	754519 59
2 656498	420835	138907	281928	754328 58
3 656717	420501	138320	282181	754137 57
4 656937	420167	137732	282435	753946 56
5 657156	419833	137145	282688	753755 55
6 657375	419500	136558	282942	753563 54
7 657594	419167	135971	283196	753372 53
8 657814	418833	135384	283450	753181 52
9 658033	418501	134797	283704	752989 51
10 658252	418168	134210	283958	752798 50
11 658470	417835	133623	284213	752606 49
12 658689	417503	133036	284467	752415 48
13 658908	417171	132449	284722	752223 47
14 659127	416839	131862	284977	752032 46
15 659346	416507	131275	285232	751840 45
16 659564	416175	130688	285487	751648 44
17 659783	415844	130102	285742	751456 43
18 660002	415513	129515	285998	751264 42
19 660220	415182	128928	286253	751072 41
20 660439	414851	128342	286509	750880 40
21 660657	414520	127755	286765	750688 39
22 660875	414190	127169	287021	750496 38
23 661094	413860	126582	287277	750303 37
24 661312	413530	125996	287534	750111 36
25 661530	413200	125410	287790	749919 35
26 661748	412870	124823	288047	749726 34
27 661966	412541	124237	288304	749534 33
28 662184	412211	123651	288561	749341 32
29 662402	411882	123064	288818	749148 31
30 662620	411553	122478	289075	748956 30

MIN.

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m.	Sines	Logarit	Differē.	Logarit.	Sines.
30	662620	411553	122478	289075	748956
31	662838	411225	121892	289333	748763
32	663056	410896	121306	289590	748570
33	663273	410568	120720	289848	748377
34	663491	410240	120134	290106	748184
35	663709	409912	119548	290364	747991
36	663926	409584	118962	290622	747798
37	664144	409257	118376	290880	747605
38	664361	408929	117790	291139	747412
39	664579	408602	117284	291398	747218
40	664796	408275	116619	291656	747025
41	665013	407948	116033	291915	746832
42	665230	407622	115447	292174	746638
43	665448	407295	114861	292434	746445
44	665665	406969	114276	292693	746251
45	665882	406643	113690	292953	746057
46	666098	406317	113105	293212	745864
47	666316	405992	112519	293472	745670
48	666532	405666	111934	293732	745476
49	666749	405341	111349	293992	745282
50	666966	405016	110763	294253	745088
51	667183	404691	110178	294513	744894
52	667399	404366	109593	294774	744700
53	667616	404042	109007	295034	744506
54	667833	403717	108422	295295	744312
55	668049	403393	107837	295556	744117
56	668265	403069	107252	295818	743923
57	668482	402746	106667	296079	743728
58	668698	402422	106082	296341	743534
59	668914	402099	105497	296602	743339
60	669131	401776	104912	296864	743145

Min

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+1-

m.	Sines	Logarith.	Diff'ren.	Logarit	Sines
0	669131	401776	104912	296864	743145 60
1	669374	401453	104327	297126	742950 59
2	669563	401130	103742	297388	742755 58
3	669779	400807	103157	297651	742560 57
4	669995	400485	102572	297913	742366 56
5	670211	400163	101987	298176	742171 55
6	670427	399841	101402	298438	741976 54
7	670642	399519	100818	298701	741781 43
8	670858	399197	100233	298964	741586 52
9	671074	398876	99648	199228	741390 51
10	671289	398555	99064	299491	741195 50
11	671505	398233	98479	299754	741000 49
12	671721	397913	97894	300018	740805 48
13	671936	397592	97310	300282	740609 47
14	672151	397271	96725	300546	740414 46
15	672367	396951	96141	300810	740218 45
16	672582	396631	95556	301074	740022 44
17	672797	396311	94972	301339	739827 43
18	673012	395991	94388	301604	739631 42
19	673228	395672	93803	301868	739435 41
20	673443	395352	93219	302133	739239 40
21	673658	395033	92635	302398	739043 39
22	673873	394714	92050	302664	738847 38
23	674087	394395	91466	302929	738651 37
24	674302	394076	90882	303194	738455 36
25	674517	393758	90298	303460	738259 35
26	674732	393440	89713	303726	738063 34
27	674946	393121	89129	303992	727867 33
28	675161	392804	88545	304258	737670 32
29	675376	392486	87961	304525	737474 31
30	675590	392168	87377	504791	737277 30

Min.

Deg. 47

Deg. 42 +

m.	Sines.	Logarith.	Differen.	Logarit.	Sines.
30	675590	392168	87377	304791	737277
31	675805	391851	86793	305058	737081
32	676019	391534	86209	305324	736884
33	676233	391217	85625	305591	736687
34	676448	390900	85042	305858	736491
35	676662	390583	84458	306126	736294
36	676876	390267	83874	306393	736097
37	677090	389951	83290	306661	735900
38	677304	389635	82706	306928	735703
39	677518	389319	82122	307196	735506
40	677732	389003	81539	307464	735309
41	677946	388688	80955	307733	735112
42	678160	388372	80371	308001	734914
43	678373	388057	79788	308269	734717
44	678597	387742	79204	308538	734520
45	678801	387427	78620	308807	734322
46	679014	387113	78037	309076	734125
47	679228	386798	77453	309345	733927
48	679441	386484	76870	309614	733730
49	679654	386170	76286	309884	733532
50	679868	385856	75703	310153	733334
51	680081	385543	75120	310423	733137
52	680295	385229	74536	310693	732939
53	680508	384916	73953	310963	732741
54	680721	384603	73370	311233	732543
55	680934	384290	72786	311503	732345
56	681147	383977	72203	311774	732147
57	681360	383664	71620	312045	731949
58	681573	383352	71036	312316	731750
59	681786	383040	70453	312587	731552
60	681998	382728	69870	312858	731354

Min

Deg. 43

<i>m</i>	<i>Sines.</i>	<i>Logarit.</i>	<i>Diff. v̄e</i>	<i>Logarit.</i>	<i>Sines</i>
0	681998	382728	69870	312858	73135460
1	682211	382416	69287	313129	73115559
2	682424	382104	68703	313401	73095758
3	682636	381793	68120	313673	73075857
4	682849	381482	67537	313944	73056056
5	683061	381170	66954	314216	73036155
6	683274	380860	66371	314488	73016254
7	683486	380549	65788	314761	72996353
8	683698	380238	65205	315033	72976452
9	683911	379928	64622	315305	72956551
10	684123	379618	64039	315578	72936650
11	684335	379307	63456	315851	72916749
12	684547	378998	62873	316124	72896848
13	684759	378688	62290	316398	72876947
14	684971	378378	61707	316671	72857046
15	685183	378069	61125	316944	72837145
16	685395	377760	60542	317218	72817244
17	685607	377451	59959	317492	72797343
18	685818	377142	59376	317766	72777442
19	686030	376834	58793	318040	72757541
20	686242	376525	58210	318315	72737640
21	686453	376217	57628	318589	72717739
22	686665	375909	57045	318864	72697838
23	686876	375601	56462	319139	72677937
24	687088	375293	55879	319414	72658036
25	687299	374986	55297	319689	72638135
26	687510	374679	54714	319964	72618234
27	687721	374371	54131	320240	72598333
28	687932	374064	53549	320515	72578432
29	688144	373758	52966	320791	72558531
30	688355	373451	52384	321067	72538630

Min.

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Deg. 43 +1-

	Sines	Logarit.	Differē.	Logarit.	Sines	
30	688355	373451	52384	321067	725374	30
31	688566	373145	51801	321343	725174	29
32	688776	372838	51219	321620	724974	28
33	688987	372532	50636	321896	724773	27
34	689198	372226	50054	322173	724573	26
35	689409	371921	49471	322449	724372	25
36	689620	371615	48889	322726	724172	24
37	689830	371310	48306	323003	723971	23
38	690041	371004	47724	323281	723770	22
39	690251	370700	47141	323558	723570	21
40	690462	370395	46559	323836	723369	20
41	690672	370090	45976	324114	723168	19
42	690882	369785	45394	324392	722967	18
43	691093	369481	44811	324670	722766	17
44	691303	369177	44229	324948	722565	16
45	691513	368873	43647	325226	722364	15
46	691723	368569	43064	325505	722163	14
47	691933	368266	42482	325783	721961	13
48	692143	367962	41900	326062	721760	12
49	692353	367659	41318	326341	721559	11
50	692563	367356	40735	326620	721357	10
51	692773	367053	40153	326900	721156	9
52	692982	366750	39571	327179	720954	8
53	693192	366448	38989	327459	720753	7
54	693402	366145	38407	327739	720551	6
55	693611	365843	37824	328019	720349	5
56	693821	365541	37242	328299	720148	4
57	694030	365239	36660	328579	719946	3
58	694240	364938	36078	328860	719744	2
59	694449	364636	35496	329140	719542	1
60	694658	364335	34914	329421	719340	0

Min.

Deg. 46

Deg. 44 +1-

m.	Sines.	Logarit.	D. fere.	Logarit.	Sines.
0	694658	364335	34914	329421	719340
1	694868	364034	34331	329702	719138
2	695077	363733	33749	329983	718935
3	695286	363432	33167	330265	718733
4	695495	363131	32585	330546	718531
5	695704	362831	32003	330828	718329
6	695913	362531	31421	331110	718126
7	696122	362231	30839	331392	717924
8	696330	361931	30257	331674	717721
9	696539	361631	29675	331956	717519
10	696748	361331	29093	332238	717316
11	696959	361032	28511	332521	717113
12	697165	360733	27929	332804	716911
13	697374	360434	27347	333087	716708
14	697582	360135	26765	333370	716505
15	697790	359836	26183	333653	716302
16	697999	359538	25601	333937	716099
17	698207	359239	25019	334220	715896
18	698415	358941	24437	334504	715693
19	698623	358643	23855	334788	715489
20	698832	358345	23273	335072	715286
21	699040	358048	22691	335357	715083
22	699248	357750	22109	335641	714880
23	699455	357453	21527	335926	714676
24	699663	357156	20945	336210	714473
25	699871	356859	20363	336495	714269
26	700079	356562	19782	336781	714065
27	700287	356266	19200	337066	713862
28	700494	355969	18618	337351	713658
29	700702	355673	18036	337637	713454
30	700909	355377	17454	337923	713250

Min.

Deg. 45

Deg. 44 +1-

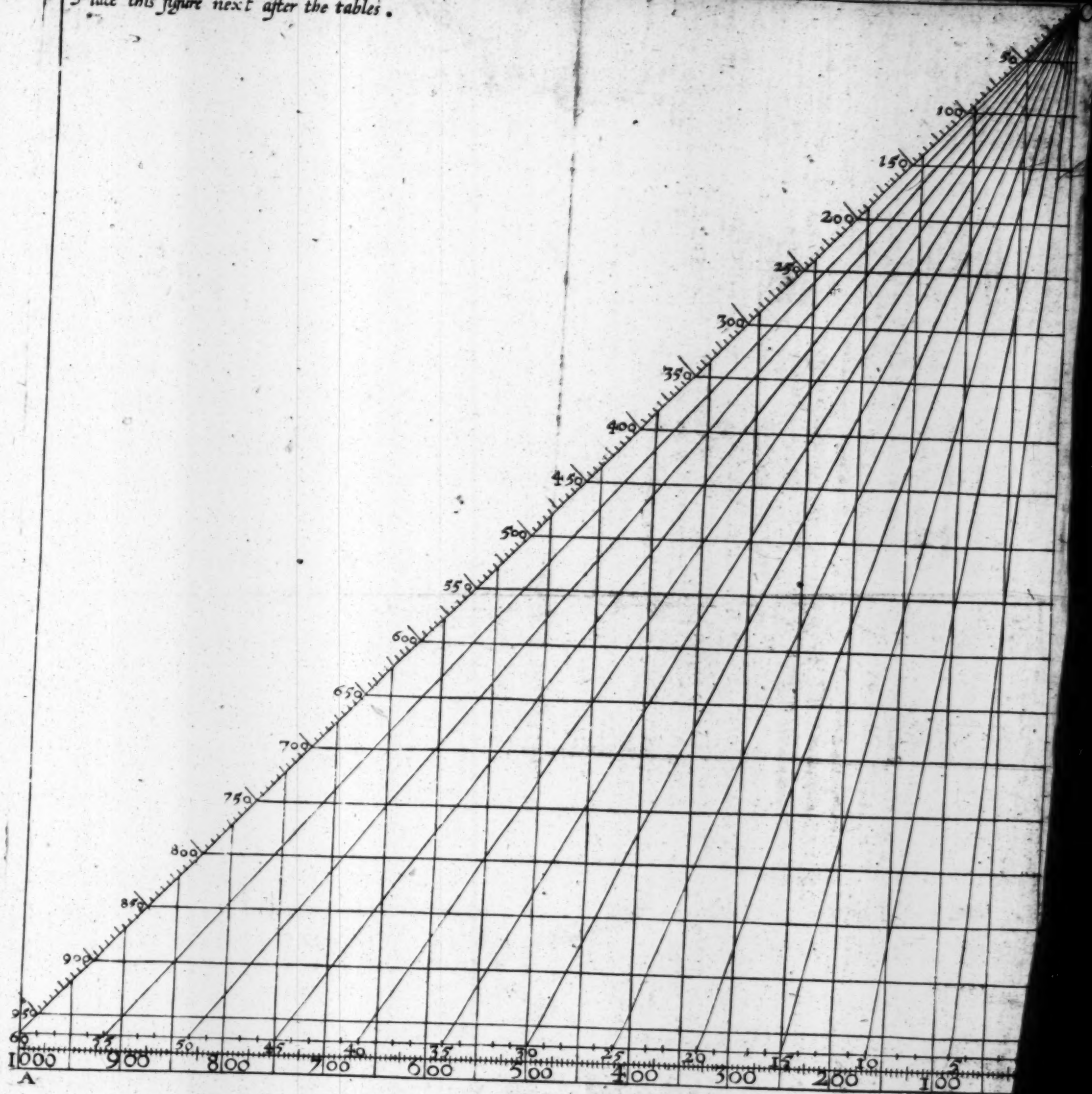
m.	Sines	Logarit	Differè.	Logarit.	'Sines.
30	700909	355377	17454	337923	713250
31	701117	355081	16872	338208	713046
32	701324	354785	16190	338495	712842
33	701531	354489	15709	338781	712638
34	701739	354194	15127	339067	712434
35	701946	353899	14545	339354	712230
36	702153	353604	13963	339641	712026
37	702360	353309	13381	339927	711822
38	702567	353014	12800	440215	711617
39	702774	352720	12218	340502	711413
40	702981	352425	11636	340789	711209
41	703188	352131	11054	341077	711004
42	703395	351837	10472	341365	710799
43	703601	351543	9890	341653	710595
44	703808	351249	9309	341941	710390
45	704015	350956	8727	342229	710185
46	704221	350662	8145	342518	709981
47	704428	350369	7563	342806	709776
48	704634	350076	6982	343094	709571
49	704841	349781	6401	343383	709366
50	705047	349491	5818	343673	709161
51	705253	349198	5236	343962	708956
52	705459	348906	4654	344252	708750
53	705665	348614	4073	344541	708545
54	705872	348322	3491	344831	708340
55	706078	348030	2909	345121	708134
56	706284	347738	2327	345411	707929
57	706489	347447	1745	345701	707724
58	706695	347156	1164	345992	707518
59	706901	346864	582	346283	707312
60	707107	346573	0	346573	707107

Min.

Deg. 45

100
A

Place this figure next after the tables.





THE VSE OF THE TRI-
angular Table for the finding of
the part Proportionall, penned
by Henry Briggs.



HE compendiousnesse of these Tables of *Logarithmes*, cannot be without some defect, which is to be supplied (as in all other Tables) by the part proportionall: that whereas sometimes the number we desire, is not to be found in the Table, we may by the difference of that number, the number in the Table neereſt vnto it, and the proportionall part answerable to that difference, haue our desire, ſo neere as may be, or is needfull. This proportionall part is had three wayes.

1. Either by the Rule of Proportion, commonly called the Golden Rule: Or
2. By the helpe of this Table of *Logarithmes*. Or

3. By this Triangular instrumentall Table. Of which three wayes the first is moſt exact, and the laſt moſt eaſie, but not ſo exact as the other two. All theſe wayes hauing three numbers giuen, do helpe vs to finde the fourth proportionall number. The manner of the operation is beſt ſhewed by example.

Pag. 81. lin. 15. we haue found that 141766 is the *Logarithme* of halfe the angle P Z S. which number I ſeek in the Table, and finde it not; but the two *Logarithmes* next vnto it,
are

are 141834 and 141667, which answere to 12' & 13' minuts about 60 degrees: so that it is apparant, that the arke which we seeke is 60: 12' and more. Now to finde how much more is to be added to this number, I take the difference of the tabular Logarithmes, 167 being first of the three numbers, which before I said must be giuen, and the difference of the two answerable tabular arkes 60 seconds, which is the second giuen number, and these two may fitly be termed *Tabular differences*. The third giuen number which we call the *Ocurring difference*, is the difference of the former of the two Tabular Logarithmes, and of this Logarithme 141766 which we seeke for: which difference is 68. These three giuen numbers 167. 60. 68 do helpe vs to the part proportionall, to be added to 60: 12', by euery one of the three former wayes.

1. By the golden rule I multiply the third 68, by the second 60, and the product 4080 being diuided by the first 167, giueth in the quotient $24 \frac{1}{2}$ almost, so that the arke answering to halfe the angle P Z S, is found to be 60: 12' $24 \frac{1}{2}$.

2. By this Table of Logarithmes thus, I take the Logarithmes of these three giuen numbers, so neere as the bare Table will affoord, without any further curious search (because in this case I need not seeke to be exact; and for the same cause I cut off the two last figures in euery Logarithme) the Logarithmes I find to be 17928.5109 3943. But because the numbers in the Table, to which the Logarithmes are adioyned, are *Sines*, and I haue found these Logarithmes answerably, as if the giuen numbers were 167. 600. 681. It is therefore appa-

rant, that the fourth proportionall, which I seeke for, must likewise increale aboue the totall *Sine*; so that his Logarithme is lesse then nothing, and the number answering to it is not to be found in this Table. Therefore by the 4. chap. 1. lib. the 9 Sect. pag 18. I doe adde 23025 (cutting off here also the two last figures) to the Logarithme of 680: therefore the third number being 68, and not 680, his Logarithme by this new increase is 28134. And because by the 5 prop. 2. chap. lib. 1. the Logarithmes of the two middle numbers are equall to the Logarithmes of the two extreame proportionals, therefore out of 32077, the summe of the two middle Logarithmes I take 17928, the Logarithme of the first, and there remaineth 14149. the Logarithme of the fourth proportionall, which I desire: to the which, in the Table, 243 doth answeare. Therefore I say, as before, that the proportionall part to bee added to the arke found, is $24\frac{3}{10}$. For though the fourth proportionall 243 be of 3 figures, yet wee may presently discern that the cause of this greatnesse in this last proportionall is because the one of the two middle numbers is too great, which should be onely 60 and 68, and that if here we cut off the last figure, then will the foure numbers keepe due proportion 167.60.68. $24\frac{3}{10}$.

3 The third way of finding this proportionall part, is by this triangular table which was drawne by Mr. E. Wright; and because at his death he left no description of it, nor manner how to vse it, at the request of some friends, I make bold to supply his place so well and plainly as I can.

You

You see then in this triangle, three sorts of lines, some paralell to the base AB, others perpendicular vnto it, and the third sort drawne all from the verticall angle C, vnto equall partes of the base. These last may be called *Diagonall* lines.

You see likewise the base AB diuided into 60 equall parts, and a line vnder it, and paralell vnto it into 1000.

In like sort, the perpendicular line CB is diuided into 1000, and vpon the intersections of the paralells, and the *Diagonall* CA are set the same numbers that are set vpon the other ends of the paralels, in the perpendicular CB. Amongst these numbers we must place our three giuen numbers, and by helpe of the lines we shall amongst the same, finde out Geometrically, the fourth proportionall, which we desire.

For Example.

Take the same numbers wee had before 167, and 60. the two Tabular Differences, and 68 the Occurring difference. Of these there are two which are differences of Logarithmes, to wit, 167, and 68, the first and the third: these being of one kinde, or Homogeneall, are to haue like situation in the Triangle. And the second being Homogeneall to the fourth, which is sought for, is to bee placed on a differing side from the other two, vpon which differing side the fourth proportionall is to bee found. As here I take 167, and 68, and count them from the poynt C in the *Diagonall* line CA, and supposing a perpendicular line to bee drawne from the end of the lesse number till it cut the paralel

(5)

parallel line drawne from the end of the greater number, by this poynt of Interfection I drawe an imaginarie Diagonall line from the poynt C, till it cut the Base AB, and counting from B to that Diagonall, I finde 24, and about $\frac{1}{2}$, which is the part proportionall I desire, as in the former operations.

But because 167 and 68 are such small numbers, and fall so neere the angle, therefore the concurrence of the parallel and perpendicular is not so exactly discerned, and the whole operation is more troublesome and uncertaine. It is therefore convenient in such cases, to take the double, or treble of both these given numbers, or the halfes, or any like parts of them both: and to enter the Table with these other numbers, in stead of the former, proceeding in all things as before; then shall we, when the numbers reach neerer vnto the Base, finde the poynt of concurrence, and the part proportionall more exactly and easily then before. As if we take 835 and 340 the quintuples of the first and third numbers, wee shall more plainly and distinctly finde the fourth proportionall to be $24\frac{1}{2}$.

In like sort, page 32, line 36, I would finde the differentia answering to $16^{\circ} : 24' : 27''$. and because the Table extendeth but to minutes, I must finde the part proportionall answering to $27''$. Here the first given number is the Tabular difference of minutes $60'$: the third number is the Occurring Homogeneall difference $27''$. The second given number is the Tabular difference of the Differentials 1074 . These three I place thus: The first $60'$.

K.

and

(6)

and the third 27 , being *Homogeneall* vnto it, I place vpon the base AB : and because the second 1074 is too great for the table, & if one figure be cut away 107 remaining wil fall vpon the Diagonall line CA (on the which it is to be placed) too neere to the angle C , therefore I take 537 , the halfe of the second, and place it vpon the Diagonall line CA , drawing a paralell from that poynt, till it meete with the Diagonall comming from 27 , and from the concourse of that paralell with this Diagonal, I draw a perpendicular vpwards, till it cut the Diagonall line of 60 . or the line CA , and I finde that the distance of this intersection from C , is about 240 , which is the halfe of the fourth proportionall, because 537 is the halfe of the second giuen number *Homogeneall* vnto this fourth. I say therefore that the part proportionall answering vnto 27 , is 480 . which being subducted from 1223101 , the differentiaall of $16^{\circ} : 24$, there remaineth 1222621 for the differentiaall of $16^{\circ} : 24, 27$, which differeth somewhat from that differentiaall which is set downe in the booke : the reason whereof is, because in so small a Table it is impossible to discerne all the severall parts, the omission of which will make no sensible difference in any worke. If in seeking the square roote, or cubicke roote of 19 , I would finde the Logarithme of 190000 , seeking this number amongst the *Sines*, I cannot finde it, but at $10^{\circ} : 57$ I finde 189952 , which is lesse then the giuen number by 48 . This is the *Occurring difference*. The tabular difference *Homogeneall* to this, is 286 . The other tabular difference of the Logarithmes is 1502 : these differences are giuen, which being placed in due order, the first of them

(7)

them is 286. the second 1502, the third 48, and that the first & third number may fall neerer to the base, I double them both, so haue I 572, and 96, these I place, in stead of the other giuen numbers, vpon the perpendicular C B, or on the Diagonall C A. Likewise because the second number 1502 is too great, I take the the halfe of it, so haue I 751, which I place vnder the base A B, vpon the line diuided into 1000: and from that point draw a diagonall, till it meete with the paralell of 96, the third number, and from the poynt of concourse with that paralell, I draw a perpendicular, till it crosse the paralell of 571 the first number. By this last concourse of the perpendicular and paralell, I draw an other diagonall, cutting the line vnder A B, in which the second number was counted, and the parts 125 betwixt that poynt and the end of the line towards B, being doubled, (because the second being Homogeneall to this, was halfed) are the fourth proportionall required, which may bee 250. and this proportionall being taken away from the tabular Logarithme 1660982, leaueth 1660732 for the Logarithme of 190000.

The same may be performed, if the first and third be placed on the base; and the second vpon the side line, thus; Draw two Diagonals from those two points of the base, & from the concourse of the Diagonall of the third with the paralell of the second, draw a perpendicular vpward, till it meete with the Diagonall of the first; the paralell passing by that point, shall in the line C B shew the fourth proportionall.

Thus may wee instrumentally come somewhat neerer to that which wee desire, especially

(8)

ally If vpon a faire large Paste-boord
wee make a great Triangle, curi-
ously diuided and lined, ac-
cording to this pat-
terne.

20

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33

44

23

488 0 58
- 82

488 6 4 0

FINIS.

131 6557

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~~131 6557~~

~~1037364~~

112 205 17:3

52 1499

488 0 58

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1804 615

Errata in the Treatise.

Pag. 15. lin. 28. make it Tangents 1370505

lin. 29. Make it number 1370305

Pag. 19. lin. 25. read 4605168—00

Pag. 21. lin. 33. read —34914—00

Pag. 29. lin. 10. read —693147

Pag. 45. lin. 4. read ZSP

Pag. 72. lin. 30. read ZP.

Pag. 75 lin. 17. read halfe the aggregate.

Handwritten notes and corrections in cursive script, including phrases like 'which is the number sought' and 'which is the number sought'.

board

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